SEDAR

SouthEast Data, Assessment, and Review

SEDAR 9

Stock Assessment Report 3

Gulf of Mexico

Vermilion Snapper

SECTION 2. Data Workshop

Results of the SEDAR 9 Data Workshop

June 20-24 2005

New Orleans, LA

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1. Introduction

1.1 Workshop Time and Place

The SEDAR 9 Data Workshop was held June 20 – 24, 2006, at the Hotel Monteleone in New Orleans, LA.

1.2 Terms of Reference

1. Characterize stock structure and develop a unit stock definition.
2. Tabulate available life history information (e.g., age, growth, natural mortality, reproductive characteristics). Provide models to describe growth, maturation, and fecundity by age, sex, or length as appropriate; recommend life history parameters (or ranges of parameters) for use in population modeling; evaluate the adequacy of life-history information for conducting stock assessments.
3. Provide indices of population abundance. Consider fishery dependent and independent data sources; develop index values for appropriate strata (e.g., age, size, area, and fishery); provide measures of precision; conduct analyses evaluating the degree to which available indices adequately represent fishery and population conditions. Document all programs used to develop indices, addressing program objectives, methods, coverage, sampling intensity, and other relevant characteristics.
4. Characterize commercial and recreational catches, including both landings and discard removals, in weight and numbers. Evaluate the adequacy of available data for accurately characterizing harvest and discard by species and fishery sector. Provide length and age distributions if feasible.
5. Evaluate the adequacy of available data for estimating the impacts of current management actions.
6. Recommend assessment methods and models that are appropriate given the quality and scope of the data sets reviewed and management requirements.
7. Provide recommendations for future research in areas such as sampling, fishery monitoring, and stock assessment. Include specific guidance on sampling intensity and coverage where possible.
8. Prepare complete documentation of workshop actions and decisions (Section II. of the SEDAR assessment report).

1.3 Participants

Name	Affiliation
Workshop Participants:	
Robert Allman	NMFS/SEFSC Panama City, FL
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1.4 Document List

Document #	Title	Authors
Documents Prepared for the SEDR 9 Data Workshop		
SEDAR9-DW1	History of vermillion snapper, greater amberjack, and gray triggerfish management in Federal waters of the US Gulf of Mexico, 1984-2005	Hood, P
SEDAR9-DW2	Vermillion Snapper Otolith Aging: 2001-2004 Data Summary	Allman, R J., J. A. Tunnell. B. K. Barnett
SEDAR9-DW3	Reproduction of vermillion snapper from the Northern and Eastern Gulf of Mexico, 1991-2002.	Collins, L. A., R. J. Allman, and H. M Lyon
SEDAR9-DW4	Standardized catch rate indices for vermilion snapper landed by the US recreational fishery in the Gulf of Mexico, 1986-2004	Cass-Calay, S. L.
SEDAR9-DW5	Standardized catch rate indices for vermilion snapper landed by the US commercial handline fishery in the Gulf of Mexico, 1990-2004	Kevin J. McCarthy and Shannon L. Cass-Calay
SEDAR9-DW6	Standardized catch rates of vermilion snapper from the US headboat fishery in the Gulf of Mexico, 1986-2004	Craig A. Brown
SEDAR9-DW7	Estimated Gulf of Mexico greater amberjack recreational landings (MRFSS, Headboat, TXPW) for 1981-2004	Guillermo Diaz
SEDAR9-DW8	Size frequency distribution of greater amberjack from dockside sampling of recreational landings in the Gulf of Mexico 1986-2003	Guillermo Diaz
SEDAR9-DW9	Size frequency distribution of greater amberjack from dockside sampling of commercial landings in the Gulf of Mexico 1986-2003	Guillermo Diaz
SEDAR9-DW10	Standardized catch rates of gulf of Mexico greater amberjack for the commercial longline and handline fishery 1990-2004	Guillermo Diaz
SEDAR9-DW11	Length Frequency Analysis and Calculated Catch at Age Estimations for Commercially Landed Gray Triggerfish (*Balistes capriscus*) From the Gulf of Mexico	Steven Saul
SEDAR9-DW12	Estimated Gray Triggerfish (*Balistes capriscus*) Landings From the Gulf of Mexico Headboat Fishery	Steven Saul
SEDAR9-DW13	Estimated Gray Triggerfish (*Balistes capriscus*) Commercial Landings and Price Information for the Gulf of Mexico Fishery	Steven Saul
SEDAR9-DW14	Estimated Gray Triggerfish (*Balistes capriscus*) Recreational Landings for the State of Texas	Steven Saul
SEDAR9-DW15	Estimated Gray Triggerfish (*Balistes capriscus*) Landings From the Marine Recreational Fishery Statistics Survey (MRFSS) In the Gulf of Mexico	Steven Saul and Patty Phares
SEDAR9-DW16	Length Frequency Analysis for the Gray Triggerfish (*Balistes capriscus*) Recreational Fishery In the Gulf of Mexico	Steven Saul
SEDAR9-DW17	Estimates of Vermilion Snapper, Greater Amberjack, and Gray Triggerfish Discards by Vessels with Federal Permits in the Gulf of Mexico	Kevin J. McCarthy

SEDAR9-DW18	Size Composition Data from the SEAMAP Trawl Surveys	Scott Nichols
SEDAR9-DW19	Species Composition of the various amberjack species in the Gulf of Mexico	Ching-Ping Chih
SEDAR9-DW20	Standardized Catch rates of Gulf of Mexico greater amberjack catch rates for the recreational fishery (MRFSS, Headboat) 1981-2004	Guillermo Diaz
SEDAR9-DW21	SEAMAP Reef Fish Survey of Offshore Banks: Yearly indices of Abundance for Vermilion Snapper, Greater Amberjack, and Gray Triggerfish	Gledhill, et. al.
SEDAR9-DW22	Data Summary of Gray Triggerfish (*Balistes capriscus),*Vermilion Snapper (*Rhomboplites aurorubens)*, and Greater Amberjack (*Seriola dumerili)* Collected During Small Pelagic Trawl Surveys, 1988 – 1996	G. Walter Ingram, Jr.
SEDAR9-DW23	Abundance Indices of Gray Triggerfish and Vermilion Snapper Collected in Summer and Fall SEAMAP Groundfish Surveys (1987 – 2004)	G. Walter Ingram, Jr.
SEDAR9-DW24	Review of the Early Life History of Vermilion Snapper, *Rhomboplites auroubens,* With a Summary of Data from SEAMAP plankton surveys in the Gulf of Mexico: 1982 – 2002	Lyczkowski-Shultz, J. and Hanisko, D.
SEDAR9-DW25	Review of the early life history of gray triggerfish, *Balistes capriscus,* with a summary of data from SEAMAP plankton surveys in the Gulf of Mexico: 1982, 1984 – 2002	Lyczkowski-Shultz, J., Hanisko, D. and Zapfe, G.
SEDAR9-DW26	Shrimp Fleet Bycatch Estimates for the SEDAR9 Species	Scott Nichols
SEDAR9-DW27	SEAMAP Trawl Indexes for the SEDAR9 Species	Scott Nichols
SEDAR9-DW-28	Standardized Abundance Indices for Gulf of Mexico Gray Triggerfish (*Balistes capriscus)* based on catch rates as measured by the Marine Recreational Fisheries Statistics Survey (MRFSS)	Josh Sladek Nowlis
SEDAR9-DW-29	Standardized Abundance Indices for Gulf of Mexico Gray Triggerfish (*Balistes capriscus)* based on catch rates as measured by the NMFS Southeast Zone Headboat Survey	Josh Sladek Nowlis
SEDAR9-DW-30	Standardized Abundance Indices for Gulf of Mexico Gray Triggerfish (*Balistes capriscus)* based on catch rates as measured from commercial logbook entries with handline gear	Josh Sladek Nowlis
SEDAR9-DW-31	Estimated Gulf of Mexico vermillion snapper recreational landings (MRFSS, headboat, TPWD) for 1981-2004	Shannon & Guillermo

2. Life History

2.1 Stock Definitions

A preliminary report (Swartz and Bert, 2003) on the stock structure of vermilion snapper based on genetic information from samples taken from the eastern and western Gulf of Mexico, Florida Keys, east coast of Florida, North Carolina and Venezuela indicated some differences between areas. Samples from Venezuela were different than U.S. samples and Western gulf samples were different than those from other U.S. locations. However sample size was too small (<10) to derive any definitive conclusions. Differences in vermilion snapper age structure have been apparent over the last decade with western gulf fish older on average than eastern gulf fish (Allman et al., 2001; Allman et al. 2005). It was noted that Florida Fish and Wildlife Conservation Commission expected to have a report on results of additional studies of vermilion snapper genetics in the Gulf of Mexico and the Atlantic by mid July. The committee recommended that the results be sent to assessment scientists working on vermilion snapper for the SEDAR9 Assessment Workshop and that the report be submitted to that workshop for review.

2.2 Habitat

In the South Atlantic Bight, vermilion snapper are associated with live bottom habitat, rock rubble and outcroppings (Grimes 1978). Diver surveys and video data from the NMFS Panama City laboratory indicate that vermilion snapper are generally associated with low profile hard bottom habitat in the Gulf of Mexico. Unlike young-of- the-year (YOY) red snapper, YOY vermilion snapper appear to be associated with reef sites, often schooling above the reef.

2.3 Morphometrics and Conversion Factors

Conversions for length and weight were presented to the data workshop. Vermilion snapper lengths are generally recorded as either total length (TL) or fork length (FL). When necessary, fork length was converted to total length using Equation 1 (n=1413).

$$TL(mm) = 1.11 * FL(mm) - 0.16 \qquad \text{(Eq. 1)}$$

The length weight relationship was estimated using 1333 vermilion snapper for which both total length (TL) and whole weight (WW) were recorded (Equation 2).

$$TW\ (kg) = 2E\text{-}08 * TL(mm)^{2.98} \qquad \text{(Eq. 2)}$$

2.4 Age and Growth

Previous studies have examined the age and growth of vermilion snapper from the Gulf of Mexico using scales (Nelson, 1988; Zastrow, 1984; Barber, 1989) and otoliths (Barber, 1989; Hood and Johnson, 1999; Allman et al., 2001). Otoliths are believed to be more readable, and provide greater reader agreement than scales for aging vermilion snapper. Also, the annual formation of otolith increments has been verified for vermilion snapper (Hood and Johnson, 1998).

Since the last full assessment in 2001 (Porch and Cass-Calay, 2001), 9,998 vermilion snapper otoliths were collected along with corresponding morphological data. These were collected from 2001 through 2004. Most samples were collected off Florida (82%). A summary of the number of vermilion snapper age estimates from 1994 through 2004 is given by state and fishing sector in Table 1.1. To estimate reader precision, a reference set of 200 otoliths was used to compare reader precision between two groups of readers and ages compared using average percent error (APE; Beamish and Fournier, 1981). Fifty-seven percent of age readings were in agreement and 94% were within ± 1 year. Average percent reader error (APE) was 5.17% (CV = 7.14%). Production aging laboratories generally consider an APE ≤5% as a target for moderately long-lived species with relatively difficult to read otoliths (Morison et al., 1998; Campana, 2001). Precision estimates for vermilion snapper age estimates have improved since the last reported comparison of vermilion ages in which APE was 8.4% (Allman et al., 2001). Typically most of the disagreement between readers is due to difficulty establishing the first or core ring, which seems to be a common problem for many reef fish (Fowler 1995). Opaque zones near the core often make distinguishing the first annulus difficult. A total of 8,776 vermilion snapper otoliths were processed for aging from 2001 to 2004; of these, 9% were rejected due to preparation flaws or indistinguishable annuli.

Vermilion snapper collected from 2001 to 2004 ranged from 1 to 26 years for the commercial hand-line fishery, 2 to 13 years for the charter boat and headboat fisheries and 1 to 25 years for the fishery-independent survey (Fig.1.1). Age distributions from the commercial hand-line and recreational fisheries indicated that fish recruit by age 4 and age 5 respectively. Charter boat, headboat and commercial ages were significantly different (ANOVA, $p<0.001$). A Tukey's pairwise comparison indicated that means were different between the headboat and commercial fisheries and the charter boat and commercial fisheries. This was contrary to the findings of the previous reporting period (1994 to 2000) in which commercially caught vermilion snapper were on average slightly older than those from the recreational fishery (Allman et al., 2001). Few individuals beyond 10 years were recorded from any sector (2-4%).

Regional differences were apparent in both the commercial and recreational age distributions (Fig. 1.2 A&B). Commercial hand-line vermilion snapper from the western gulf were significantly older than those from the eastern gulf (ANOVA, $p<0.001$). On average western gulf fish were 1 year older than eastern gulf fish for the commercial fishery and 0.3 years older for the recreational fishery. A similar pattern was noted for the commercial fishery during 1994 to 2000 (Allman, et al. 2001) and as in previous years, few ages were available from the western gulf recreational fishery. Separate von Bertalanffy growth equations were calculated for the recreational and commercial fisheries and the east and west commercial fisheries (Table 1.2; Fig. 1.3).

An examination of the commercial hand-line age distribution by year suggested the influence of a strong 1999 year class which was visible beginning in 2002 as age 3 fish, in 2003 as age 4 fish and in 2004 as age 5 fish (SEDAR9 DW3). This strong year class was also noted in the recreational fishery with large number of age 4 fish in 2003 and age 5 fish in 2004.

Total length at age plots indicated large variation in size-at-age (Fig. 1.4). This was consistent with previous studies on vermilion snapper (Allman et al., 2001; Hood and Johnson, 1999; Zhao et al., 1997). Due in part to the large variation in size-at-age of vermilion snapper, the last stock assessment (Porch and Cass-Calay, 2001) used a non-age-based production model.

2.5 Natural Mortality

Vermilion snapper live to at least 26 years, based on age samples available (see SEDAR9 DW2). Based upon this information, and using the method of Hoenig (1983) results in a value for M of 0.16. This value is below those previously applied in vermilion snapper assessments and the general beliefs about vermilion snapper life history. Based upon these considerations, the DW suggested using a value of M of 0.25 for base line evaluations, and agreed with the range of M= 0.15 and 0.35 for sensitivity evaluations.

SEDAR 9 data workgroup recommended exploring other methods of determining natural mortality at the stock assessment workshop.

2.6 Relative Productivity and Resilience (Steepness)

The classification scheme developed at the FAO second technical consultation on the suitability of the CITES criteria for listing commercially-exploited aquatic species (Windhoek, Namibia, 22-25 October 2001; FAO 2001) was used to characterize the relative productivity of vermilion snapper. This information is provided in Table 1.3. A productivity rank was assigned to each life-history characteristic (a value of 1 was assigned for low, 2 for medium, and 3 for high productivity characteristics) and the ranks were averaged to produce an overall productivity score. This score was then used to prescribe a prior density function on steepness in the stock-recruitment relationship from the Periodic Life History strategists distribution of steepness values as summarized by Rose et. al. (2001). The dominant portion of the steepness values from these analogous species range from 0.6-0.8 with 90% of the values less than 0.9. As the vermilion snapper productivity score from this exercise is somewhat below the medium category, the data work group recommends that the prior probability density function on steepness for this species be lognormal with a mode of 0.6 and a CV such that there is no greater than a 10% probability of steepness values greater than 0.9.

2.7 Reproduction

In the last decade, two histological studies of reproduction were published on this gonochoristic and multiple-spawning species with indeterminate fecundity. A one-year study published on vermilion snapper from South Carolina by Cuellar et al. (1996) included the first estimates of batch fecundity and spawning frequency on fish <300 mm TL. Hood and Johnson (1999) also conducted a one-year study and provided information on age, growth and reproduction including the first published batch fecundity estimates for vermilion snapper <300 mm TL from the eastern Gulf of Mexico.

Another study of reproduction is being prepared for publication by NMFS-Panama City and preliminary results of this study are found in Collins et al. (2001). Results of this study are in SEDAR9 Working Document 3 (SEDAR9-DW3). The results of this most recent histological study with expanded temporal/spatial coverage of vermilion snapper reproduction will be given first in each sub-section of this section, followed by results of previous studies in each sub-section.

2.7.1 Sex ratio

Sex ratio was somewhat variable in the SEDAR9-DW3 study. Overall female:male sex ratio from all fishery sources and areas in that study was significantly female-dominated (1.48:1;

X^2=107 with critical value = 3.8, n = 2833, df = 1, and alpha = 0.05). Sex ratio was usually > 1:1 for recreational (1.72:1) and fishery-independent (1.87:1) samples and 1:1 for commercial samples (1.08:1).

Females generally seemed to decrease in dominance from the northern half of the vermilion snapper's range (North Carolina, South Carolina and northwest Florida) to the southern half (west-central Florida and Trinidad). Both Grimes (1976) and Cuellar et al. (1996) found that females off North Carolina and South Carolina made up 63 % of the total sampled (female:male sex ratio = 1.70:1). Fishery-independent samples from North Carolina were similar with 67 % female (sex ratio = 2.03:1), and commercial samples from the same area were also significantly different from 1:1 at 57 % female (sex ratio = 1.33:1) (Cuellar et al. 1996). Random samples from SEDAR9-DW3 were 60 % female (sex ratio = 1.5:1) which was significantly different than 1:1, although some individual locations did have sex ratios =1:1 or significantly < 1:1. Hood and Johnson (1999) found that the sex ratio off west-central Florida was not significantly different from 1:1 and SEDAR9-DW3 sex ratio for two locations (Homosassa and Fort Myers) near the area covered by Hood and Johnson was also 1:1. Vermilion snapper sex ratio from Trinidad was also 1:1 (Manickchand-Heileman and Phillip, 1999). It is also interesting to note that combined random samples from the commercial fishery, usually collected from deeper water than samples from the recreational fishery, were also 1:1 (SEDAR9-DW3).

2.7.2 Spawning Season/Area

The spawning season for Gulf vermilion snapper during 1991-2002 determined by histology was mid-April through mid-September (SEDAR9-WD3). Both late hydrated oocytes and ripe testes occurred during this 150 day period. The spawning period off North and South Carolina (Cuellar et al. 1996) and west-central Florida (Hood and Johnson 1999) was the same or very similar to the SEDAR9-WD3 results.

Spawning occurred all along the continental shelf of the U.S. Gulf (SEDAR9-DW3; per. comm. Joanne Lyczkowski-Shultz; SEDAR9-DW24). Catch-location data and histology allowed some spawning sites to be identified, mostly off Panama City, Florida, but sampling was opportunistic and not equal throughout the Gulf (SEDAR9-DW3).

2.7.3 Sexual Maturity

Histology indicated that both sexes of vermilion snapper were mature at all lengths sampled (153–555 mm; 1,384 females and 391 males) (SEDAR9-DW3). Only one female was immature. Relatively few fish < 200 mm were collected (n=33), but four out of five females and all three males at 150-174 mm were mature, and all 17 females and all 8 males at 175-199 mm were mature. The smallest female that we sampled (153 mm) was spent; no females with undeveloped ovaries and few females with early developing ovaries were found during the spawning season. The smallest male (161 mm) was ready to spawn and no males with undeveloped or early developing testes were found during the spawning season. Vermilion snapper were mature by age 1.

The SEDAR9-DW3 study and the two previous studies (Cuellar et al. 1996 and Hood and Johnson 1999) all found that vermilion snapper mature at < 200 mm TL and possibly as early as < 150 mm TL. Preliminary data in Collins and Pinckney (1988) showed that 60% of females and 90% of males from North Carolina, South Carolina, Georgia and northeast Florida were mature at 160 mm.

2.7.4 Fecundity

Batch fecundity from all fishery sources and areas combined was estimated as 7,385 to 407,570 hydrated oocytes (mean=73,388, SE=6,968, median=47,098) from 123 females collected in 1993-1994 and 2000-2001 (SEDAR9-DW3). Total length was an effective predictor of batch fecundity for all fish, with an exponential function explaining 66% of the variation in batch fecundity. Dates of catch on all fish ranged from late April to early September. Batch fecundity was significantly greater in large (>299 mm) fish (SEDAR9-DW3). Mean batch fecundity for small (<300 mm) fish was 41,051 (n=83, SE=1,764, median=39,941) and for large fish was 152,788 (n=40, SE=15,408, median=103,606). Batch fecundity was variable for both small and large females. Age was not an effective predictor of batch fecundity for fish which ranged from 2 to 14 yr (n=80, SEDAR9-DW3). Ages were not available for 1993 fish. SEDAR9-DW3 contains information on our spawning frequency estimate (87 spawns per year) and annual fecundity estimates (range of 0.64 to 35.5 million).

The SEDAR9 plenary group decided that four fish from off Fort Myers should be excluded from consideration in estimating fecundity because they were larger than all other fish (SEDAR9-DW3) from a site that was much deeper and further away than the area where most other samples were collected. It was also decided that TW should be analyzed as a predictor of fecundity because of the great variation in length at age (Allman et al. 2001, 2005; Hood and Johnson 1999) and the poor ability of age to predict fecundity (SEDAR9-DW3).

The four largest fish were excluded from SEDAR9-DW3 fecundity analysis during SEDAR9, and the results of this change follow. This change had no effect on the range of batch fecundity but it did slightly change the mean of batch fecundity both for all sizes of fish (189 - 395 mm TL) to 70,231 and for the large fish (> 299 mm TL) to 137,507. The new mean for the large fish (with n = 36) was still significantly greater than the mean for the small fish (<300 mm TL).

Total weight ranged from 0.09 to 0.79 kg and was regressed on annual fecundity (n = 114; Fig. 1.5). TW was an effective predictor of annual fecundity, which ranged from 0.64 to 35.5 million hydrated oocytes using a constant of 87 for spawning frequency (SEDAR9-DW3).

Batch fecundity estimates for small fish (< 300 mm TL) were similar for this report (SEDAR9-DW3), Cuellar et al. (1996) and Hood and Johnson (1999), but spawning frequency differed considerably between this report and Cuellar et al. (1996). The latter two studies estimated batch fecundity on few large fish (> 299 mm TL) whereas this report contains 40 such estimates. The difference in spawning frequency estimates of 87 in this report and 35 in Cuellar et al. (1996) is probably due to differences in estimation-methodology, areas, years and time-of-day sampled between the two studies.

2.8 Literature Cited

Allman, R. J., G. R. Fitzhugh, and W. A. Fable. 2001. Report of vermilion snapper otolith aging: 1994-2001 Data Summary. NMFS Panama City Laboratory Contribution Series 01- 01. 25 p.

Allman, R. J., J. A. Tunnell, and B. K. Barnett. 2005. Vermilion snapper otolith aging: 2001- 2004 Data Summary. NMFS Panama City Laboratory Contribution Series 05-02. 20 p.

Barber, R.C. 1989. Age and growth of vermilion snapper (Rhomboplites aurorubens) in the northern Gulf of Mexico. M.S. thesis. Texas A&M University. 87 pp.

Beamish, R.J. and D.A. Fournier. 1981. A method for comparing the precision of a set of age determinations. Can. J. Fish. Aquat. Sci. 38: 982-983.

Campana, S.E. 2001. Accuracy, precision and quality control in age determination, including a review of the use and abuse of age validation methods. Jour. Fish Bio. 59: 197-242.

Collins, M. R., and J. L. Pinckney. 1988. Size and age at maturity for vermilion snapper (Rhomboplites aurorubens) (Lutjanidae) in the South Atlantic Bight. Northeast Gulf Science 10: 51-53.

Collins, L. A., W. T. Walling, Jr., J. H. Brusher, M. G. Remy, J. J. Mikulas, G. M.Chandler, and D. M. La Fond. 2003. Preliminary results from a study of reproduction in the vermilion snapper (Lutjanidae: Rhomboplites aurorubens) from the eastern U. S. Gulf of Mexico. Gulf and Caribbean Fisheries Institute 54: 580-591.

Cuellar, N., G. R. Sedberry and D.M. Wyanski. 1996. Reproductive seasonality, maturation, fecundity, and spawning frequency of the vermilion snapper, Rhomboplites aurorubens, off the southeastern United States. Fishery Bulletin 94: 635-653.

Fowler, A.J. 1995. Annulus formation in otoliths of coral reef fish-a review. pages 45-63. In Secor, D.H., J.M. Dean, and S.E. Campana (eds.), Recent developments in fish otoliths research. The Belle W. Baruch Library in Marine Science No. 19. University of South Carolina Press, Columbia, SC.

Grimes, C. B. 1976. Certain aspects of the life history of the vermilion snapper Rhomboplites aurorubens (Cuvier) from North and South Carolina waters. Philosophy Doctoral Dissertation, University of North Carolina at Chapel Hill. 240 p.

Grimes, C.B. 1978. Age, growth, and length-weight relationship of vermilion snapper, Rhomboplites aurorubens from North and South Carolina waters. Trans. Am. Fish. Soc. 107 (3): 454-456.

Hoenig, J.M. 1983. Empirical use of longevity data to estimate mortality rates. Fish. Bull. U.S. 82: 898-902.

Hood, P.B. and A.K. Johnson. 1999. Age, growth, mortality, and reproduction of vermilion snapper, Rhomboplites aurorubens, from the eastern Gulf of Mexico. Fish. Bull. 97: 828-841.

Morison, A.K., S.G. Robertson, and D.G. Smith. 1998. An integrated system for production fish aging: image analysis and quality assurance. North American Journal of Fish. Manage. 18: 587-598.

Nelson, R.S. 1988. A study of the life history, ecology and population dynamics of four sympatric reef predators (Rhomboplites aurorubens, Lutjanus campechanus, Lutjanidae, Haemulon melanurum, Haemulidae, and Pagrus pagrus, Sparidae) on the east and west Flower Garden Banks, northwestern Gulf of Mexico. Ph.D. thesis. North Carolina State University. 197 pp.

Manickchand-Heileman, S. C., and D. A. T. Phillip. 1999. Contribution to the biology of the vermilion snapper, Rhomboplites aurorubens, in Trinidad and Tobago, West Indies, Environmental Biology of Fishes 55: 413-421.

Porch, C.E., and S.L. Cass-Calay. 2001. Status of the vermilion snapper fishery in the Gulf of Mexico assessment 5.0. NOAA/NOAA Fisheries/SEFSC/Sustainable Fisheries Division Contrib. NO. SFD-01/02-129 p.

Rose, K.A.,J.H. Cowan, K.O. Winemiller, R.A. Myers and R. Hilborn. 2001. Compensatory density dependence in fish populations: importance controversy, understanding and prognosis. Fish and Fisheries (2) 293-327.

Tringali, M.D. and M. Higham. 2005. Genetic stock structure of vermilion snapper (Rhomboplites aurorubens) in the Gulf of Mexico and Southeastern United States. Florida Fish and Wildlife Institute report number IHR2005-3. 21 pp.

Zastrow, C.E. 1984. Age and growth of the red snapper, Lutjanus campechanus, and the vermilion snapper, Rhomboplites aurorubens, from the northwestern Gulf of Mexico. M.S. thesis. Texas A&M University. 77 pp.

Zhao, B., J.C. McGovern, and P.J. Harris. 1997. Age, growth, and temporal change in size at age of the vermilion snapper from the South Atlantic Bight. Trans. Am. Fish. Soc. 126: 181-193.

Table 1.1. Number of vermilion snapper otolith ages by state and sector 1994-2004.

	AL	FL	MS	LA	TX
1994					
Commercial		28		73	
Charter boat		125		8	
Headboat		21			
Private					
Fishery-indep.					
1995					
Commercial		6		75	
Charter boat		10			
Headboat		169		13	
Private					
Fishery-indep.		5			
1996					
Commercial		6		71	
Charter boat		83			
Headboat		166		21	10
Private					
Fishery-indep.		4			
1997					
Commercial		2			
Charter boat		2			
Headboat		40			
Private		4			
Fishery-indep.					
1998					
Commercial		4	134		
Charter boat					
Headboat		12			
Private		2			
Fishery-indep.		1			
1999					
Commercial					
Charter boat	87	57	10		
Headboat	4	4			
Private	64		20		
Fishery-indep.		20	3		

Table 1.1 continued

2000					
Commercial		45		81	
Charter boat		85			

Headboat	12	110			23
Private					
Fishery-indep.		79	6		
2001					
Commercial	34	1154	67	98	
Charter boat		21			
Headboat	1	94		1	24
Private					
Fishery-indep.	6	506		16	
2002					
Commercial		1207	53	68	
Charter boat		174			
Headboat		84			
Private					
Fishery-indep.	4	198		4	
2003					
Commercial	7	2103	41	440	120
Charter boat		41			
Headboat	12	25		1	
Private		12			
Fishery-indep.		52			
2004					
Commercial	647			364	147
Charter boat	75				
Headboat	9			24	16
Private	5				
Fishery-indep.	24				

Table 1.2. Von Bertalanffy growth equations for vermilion snapper from 2001-2004.

All fishing sectors combined	TL= 426 [1-e $^{-0.2(Age + -3.9)}$], n= 7980
Recreational	TL= 377 [1-e$^{-0.5(Age + -0.5)}$], n= 619
Commercial	TL= 465 [1-e$^{-0.15 (Age + -5.0)}$], n= 6498
Commercial East	TL= 459 [1-e$^{-0.15(Age+ -5.2)}$], n= 5279
Commercial West	TL= 467 [1-e$^{-0.18(Age= -4.1)}$], n= 1219

Table 1.3. Proposed guideline indices of productivity for exploited fish species.

Parameter	**Productivity**			Species
	Low	**Medium**	**High**	Vermilion Snapper
M	**<0.2**	**0.2 - 0.5**	**>0.5**	0.15, **0.25**, 0.35
K	**<0.15**	**0.15 - 0.33**	**> 0.33**	**0.20**
t_{mat} (years)	**> 8**	**3.3 - 8**	**< 3.3**	**1**
t_{max} (years)	**>25**	**14 - 25**	**<14**	**26**
Examples	orange roughy, many sharks	cod, hake	sardine, anchovy	Vermilion Snapper Productivity Score = 1.88 (Low Medium)

Figure 1.1. Vermilion snapper length frequency distribution of age samples by fishing mode 2001-2004.

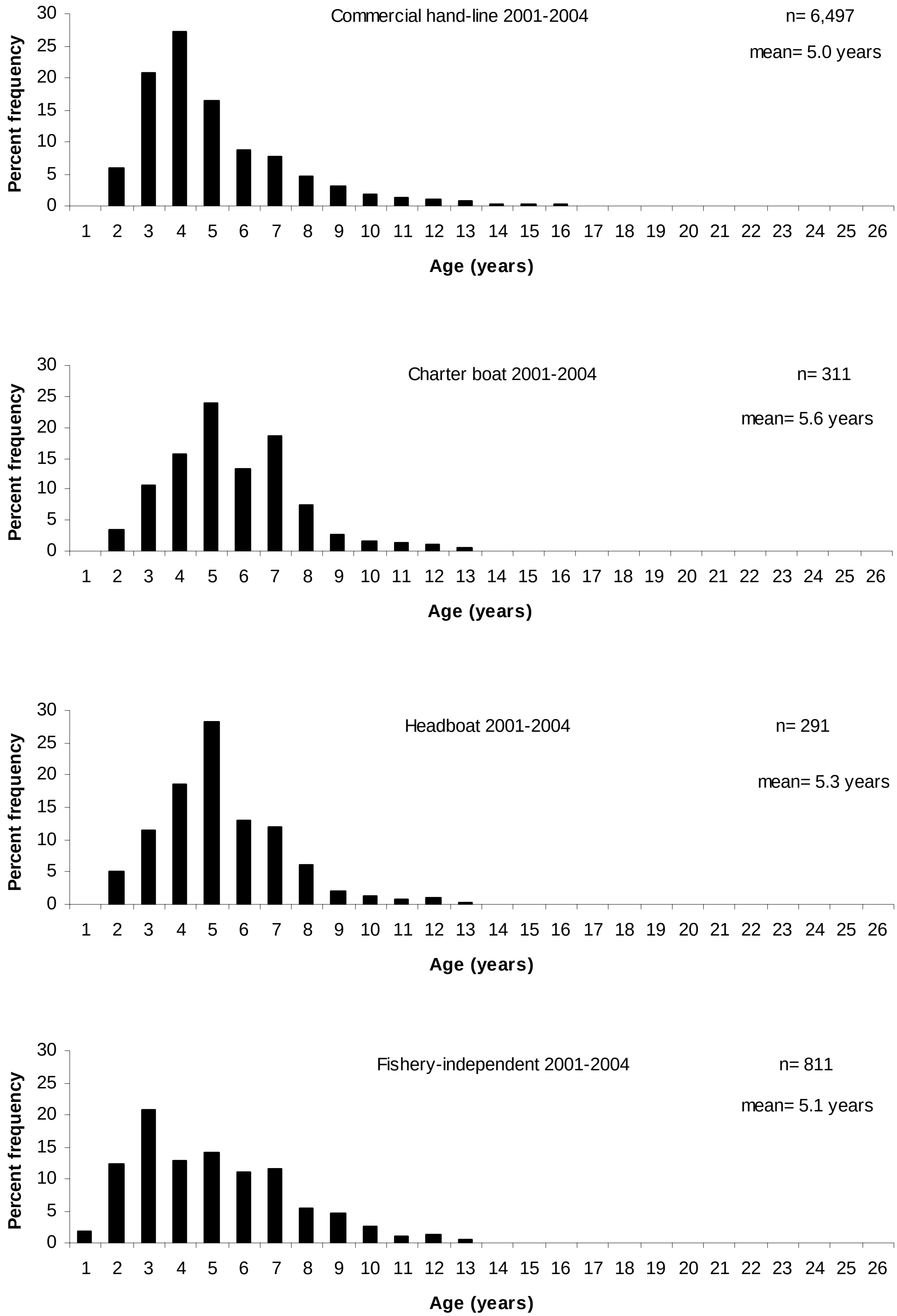


Figure 1.2. Vermilion snapper age frequency distribution of age samples by fishing mode and region 2001-2004.

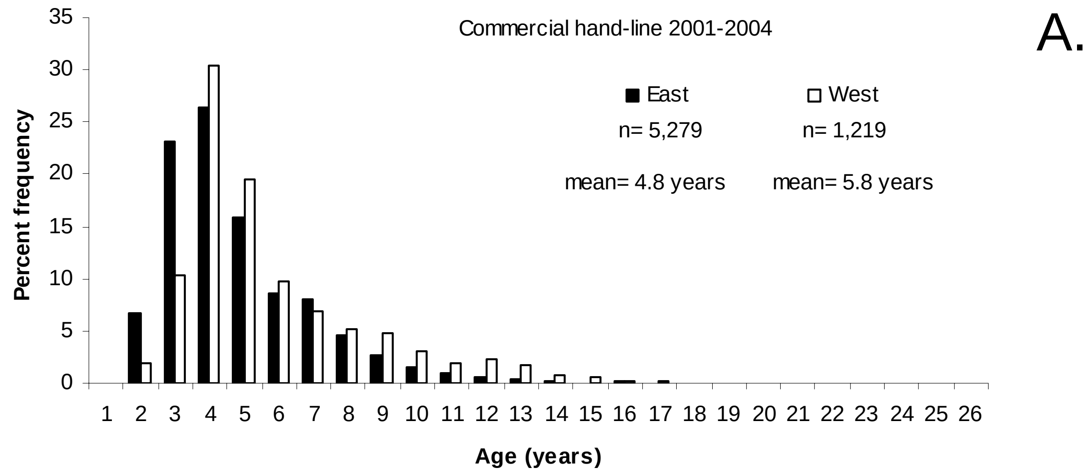


Figure 1.3. Von Bertalanffy growth curves from vermilion snapper 2001-2004.

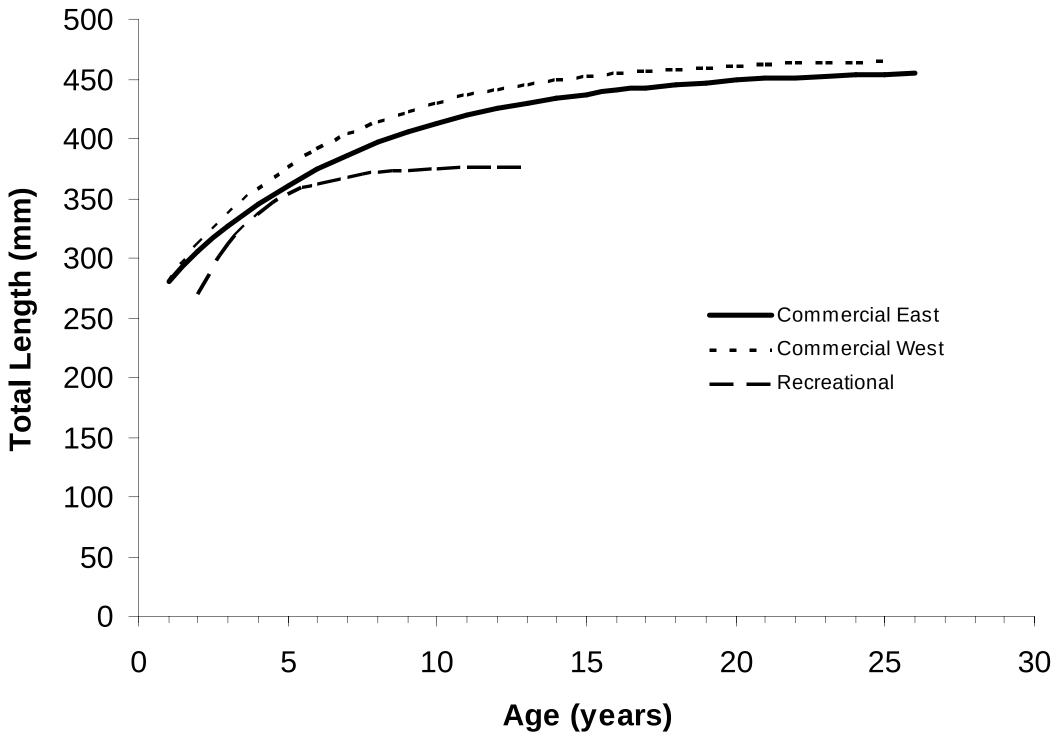
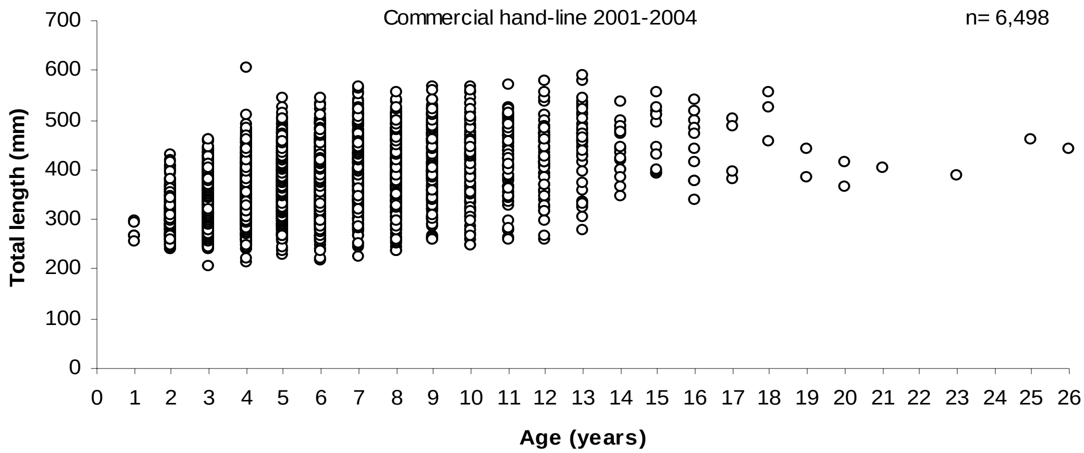


Figure 1.4. Vermilion snapper total length by age and fishing mode.



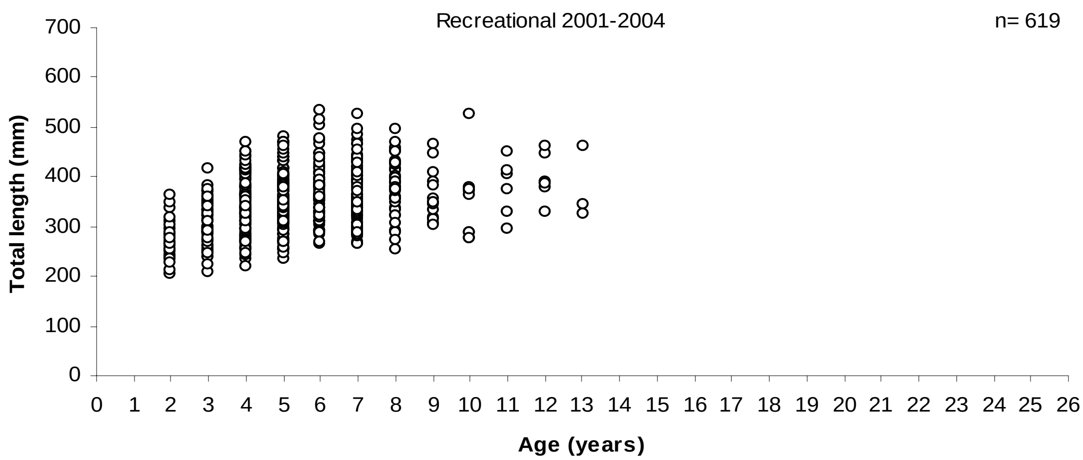
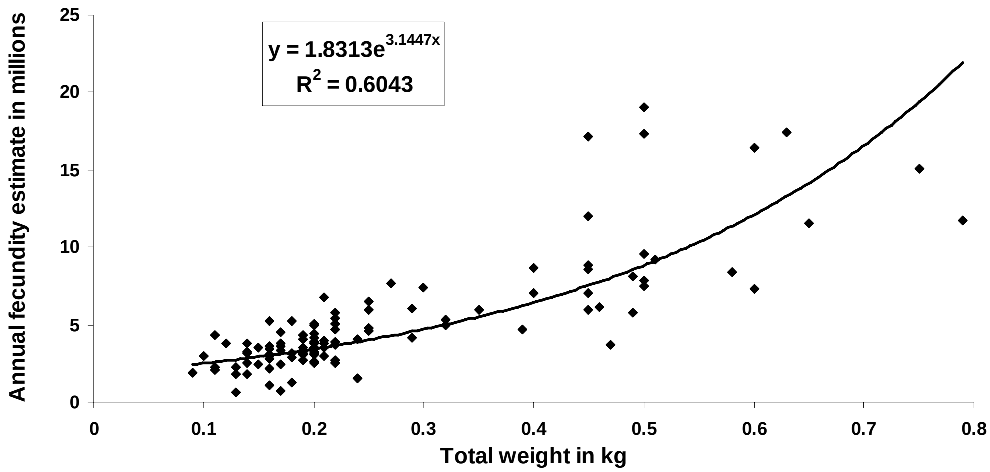


Figure 1.5 Vermilion snapper annual fecundity estimate regressed on total weight – assuming a spawning frequency estimate of 87 for all fish



3. Commercial Fishery Statistics

3.1 Commercial Landings

Commercial fishery statistics include information on landings of seafood products, fishing effort, and biological characteristics of the catch. A variety of sources of information are used to obtain these statistics.

The quantity (usually weight) and value of seafood products sold to licensed seafood dealers have been collected through various state and federal programs overtime. Currently these landing statistics are collected by state fisheries agencies in Alabama, Florida, and Louisiana on each fishing trip (trip ticket programs). In Mississippi and Texas, monthly dealer reports of landings are either sent in by the dealer or collected by state and federal port agents. Prior to the implementation of trip ticket programs landings were collected from seafood dealers each month by NMFS and state agents. Trip ticket programs generally provide information on the gear used and the fishing area. For the historical landings obtained from dealers each month, fishing gear and area were assigned by the agents on an annual basis.

At the National Marine Fisheries Service (NMFS), Southeast Fisheries Science Center (SEFSC) commercial landings statistics from North Carolina through Texas from 1962 to present are maintained in a data base referred to as the Accumulated Landings System (ALS). Statistics on all seafood products other than shrimp are maintained in that data base. Landings statistics from before 1962 are maintained by NMFS in Silver Springs, MD.

3.1.1 Commercial Data Collection Overview

Florida

Prior to 1986, commercial landings statistics were collected by a combination of monthly mail submissions and port agent visits. These procedures provided quantity and value, but did not provide information on gear, area or distance from shore. Because of the large number of dealers, port agents were not able to provide the gear, area and distance information for monthly data. Gear, area and distance from shore, however, are provided for annual summaries of the quantity and value and known as the Florida Annual Canvas data.

Beginning in 1986, mandatory reporting by all seafood dealers was implemented by the State of Florida. The state requires that a report (ticket) be completed and submitted to the state for every trip from which seafood was sold. Dealers have to report the type of gear as well as the quantity (pounds) purchased for each species. Information on the area of catch can also be provided on the tickets for individual trips (I did not think that this was correct for before about 1990). As of 1986 the ALS system relies solely on the Florida trip ticket data to create the ALS landings data for all species other than shrimp.

Alabama

Until the year 2000 data collection in Alabama was voluntary and was conducted by state and federal port agents that visit dealers and docks monthly. Summaries of the total landings (pounds) and value for species or market category were recorded. Port agents provided information on gear and fishing area from their knowledge of the fisheries and interaction with fishermen and dealers. As of mid- 2000 the State of Alabama required fishermen and dealers to report all commercial landings data through a trip ticket system. As of 2001 the ALS system relies solely on the Alabama trip ticket data to create the ALS landings data for Alabama.

Mississippi

Data collection in Mississippi is voluntary and is conducted by state and federal port agents that visit dealers and docks monthly. Summaries of the total landings (pounds) and value for species or market category are recorded. Port agents provide information on gear and fishing area from their knowledge of the fisheries and interaction with fishermen and dealers.

Louisiana

Prior to 1993, commercial landings statistics were collected in Louisiana by federal port agents following the traditional procedures established by the NMFS. Monthly summaries of the quantity and value were collected from each dealer in the state. The information on gear, area and distance from shore were added by the individual port agents.

Beginning in January 1993, the Department of Wildlife and Fisheries, State of Louisiana began to enforce the states' mandatory reporting requirement. Dealers have to be licensed by the state and are required to submit monthly summaries of the purchases that were made for individual species or market categories. With the implementation of the state statute, federal port agents did not participate in the collection of commercial fishery statistics.

After the implementation of the state program, information on the gear used, the area of catch and the distance from shore has not been added to the landings statistics (1992-1999). In 1998 the State of Louisiana required fishermen and dealers to report all commercial landings data through a trip ticket system. This data contains detailed landings information by trip including gear, area of capture and vessel information. As of 2000 the ALS system relies solely on the Louisiana trip ticket data to create the ALS landings data for Louisiana.

Texas

The state has mandatory reporting requirement for dealers licensed by the state. Dealers are required to submit monthly summaries of the quantities (pounds) and value of the purchases that were made for individual species or market categories. Information on gear, area and distance from shore are added to the state data by SEFSC personnel.

Interstate Transport

Often seafood products are landed in one state and transported by the purchasing dealer to another state; such landings may be recorded both in the state of landing and where the purchasing dealer is located. State and SEFSC personnel track these landings to assure that double counting does not occur and assign them to the state of landing.

3.1.2 Commercial Landings Data Base Organization and Data Handling

The data are organized into three primary components: historical annual data (1962-1976), monthly data (1977-present) and Florida annual data (1976-1996). The monthly 1977-present data for Florida does not have gear or fishing area for the period 1977-1996, while the annual Florida data (1976-1996) has gear and fishing area information which was provided by port agents based on their knowledge of the fisheries.

Accumulated Landings System (ALS)

1962-1976: Annual Landings by Year, State, County, Area, Gear, and Species for Florida West Coast through Texas.

1977-present: Monthly Landings by Year, Month, State, County, Area, Gear, and Species for Florida West Coast through Texas. Data reported from some states do not have information on the area and gear of capture particularly during the 1990s.

Historically the state and county recorded in the ALS indicates where the marine resource was landed. However in recent years (with the advent of trip tickets as the source of the landings data) in some states the state and county reflect the location of the main office of the purchasing dealer..

Fishing takes place in many different regions including United States waters of the Gulf of Mexico, the South Atlantic and in foreign waters. For the years 1976-present the area codes assigned to those regions are:

1. South Atlantic catch in the ALS is considered all area codes 0010, 0019, and 7xxx and higher.
2. Foreign Waters are area codes 022x- 060x and 186x.

In order to define the area of capture for Florida West coast for years 1976-1996 previous assessments use the Florida Annual Canvass data set. (Note* -The State of Florida implemented their trip ticket program in 1985 with more complete reporting starting in 1986. This data set was to contain area of capture information, but due to the nature of a public reporting, some fields on the ticket (such as area) may not have been reported consistently or completely in the early implementation years.)

Florida Annual Canvas Landings

1976-1996: Florida Annual Canvass for area and gear estimates by county which are not in the Monthly Landings for Florida West Coast.

The Florida Annual Data files from 1976 – 1996 represent annual landings by county (from dealer reports) which are broken out on a percentage estimate by species, gear, area of capture, and distance from shore. These estimates are submitted by Port agents, which were assigned responsibility for the particular county, from interviews and discussions with dealers and fishermen collected through out the year. The estimates are processed against the annual landings totals by county on a percentage basis to create the estimated proportions of catch by the gear, area and distance from shore. (The sum of percentages for a given Year, State, County, Species combination will equal 100.)

Florida Annual Canvass 1976-1996 considerations:

1. 1976-1985 Data is recorded as landed weight which for vermilion snapper was normally landed in a gutted condition. In order to convert to whole weight a factor of 1.11 was used.
2. All Area codes 0010, 0019, and 7xxx and higher are considered South Atlantic catch

3. State 00 and Grid 0000 in the data set are marine product landed else where and trucked into the State of Florida and are considered duplicated else where because they are theoretically reported back to the state of landing and are not included in the Florida totals.
4. State 12 is in the data set which represent Florida interior counties which were landed on Florida East Coast and not included in the Gulf catches.

Assignment of gear and area of capture 1990-present

The gear and fishing area designations in the landings data base has been provided by a variety of sources including port agents (annual and/or monthly landing reports), dealers (some trip ticket reports) and permit applications (some trip ticket reports, used only for gear). For some states the fishing gear and area were not reported when trip ticket programs were initiated. Beginning in 1990 fishermen have provided log books which indicate fishing gear, and area as well as catch and effort. The working group recommended that starting in 1990, landings be classified by gear and area using year and state specific information from logbooks.

3.1.3 Species composition

Species composition for vermillion snapper was reviewed for red snapper SEDAR7-DW 44. According to this report, there was no basis to infer that the species coding for vermilion snapper in the commercial landings data set was inaccurate.

3.1.4 Commercial landings by State

Commercial landings in pounds by state and year are shown in Table 2.1 and Fig 2.1. The largest quantities of vermilion snapper have been landed in Florida followed by Louisiana. The other states have accounted for comparatively smaller quantities.

3.1.5 Commercial Landings for Assessment by Gear and Area

Table 2.2 and Figure 2.2 show commercial landings by gear and region. For landings from 1990-2004 gear and statistical area were assigned from log books by year and state. The eastern and western regions were separated at approximately the Mississippi River with east including statistical areas 1-12 and the west including areas 13-21. Longline included vertical longline, trap included all pot and trap gears and handline included all other gears.

3.2 Bycatch

3.2.1 Commercial Finfish Fishery Discards

Estimates of vermilion snapper commercial discards were presented in SEDAR 9 DW 17. A 20% sample of the vessels with a Gulf of Mexico reef fish, king mackerel, Spanish mackerel or shark permit were selected to report discards. Data were available for the period August, 2001 through December, 2004. There were about 300 that reported vermilion snapper. Generalized linear model (GLM) analyses were used to determine those variables with significant effects on the proportion of trips reporting discards of the species of interest and on the catch rates (in number of fish) of trips reporting discards. Multiple factors were found to influence discard rates by species, but sampling period (August-December and January-July each year) and the number of hooks fished per line were consistently identified as the most important factors influencing discard rates

The estimated number of discards was calculated by multiplying the number of trips in a stratum by the average catch rate in the stratum with the strata defined by the results of the general linear models and by the amount of available data (a minimum of 30 observations per stratum). Estimates were made only for the handline fishery (included electric reel and hydraulic 'bandit rig' gear) due to small sample sizes of discards reported from other gears. Discard estimates were made for each of the seven sampling periods (each about a half year) and for species specific levels of hooks per handline. Additionally estimates were calculated for years before the discard program was initiated. These were made using the 2001-2004 average discard rates for each stratum. These pre-July 2001 estimates were made only for periods when the size limit was the same as the size limit in 2001-2004.

Annual estimated discards are summarized in Table 2.3. The time series for vermilion snapper was truncated at the point when size regulations went into effect (September 14, 1997). Therefore estimates for vermilion were made only for part of 1997 and 1998-2004. The committee reviewed the discard estimates of vermilion snapper in detail because of the magnitude of the estimates for 2002 (SEDAR 9 DW 17). That review found no obvious difference in the frequency of trips reporting high numbers of discards during 2002 and showed patterns of frequency distributions which were similar to adjacent sampling periods throughout the years covered by the survey.

The committee reviewed the average weight of discarded vermilion snapper estimated from the discard reports and the raw data used to make those estimates. Many of the reported weights were as large or larger than the weight of landed fish. The committee concluded that the reported weights might be a mixture of the average weight of individual fish, the average weight of all vermilion snapper discarded per day and possible other statistics. The committee therefore recommended that the average weight data from the discard reports not be used.

3.2.2 Shrimp Fishery Bycatch

The Bayesian techniques used to estimate shrimp fleet bycatch for red snapper during SEDAR7 (SEDAR7-DW-3 and -54) were applied to vermilion snapper, gray triggerfish, and greater amberjack in SEDAR9-DW-26. Results for all three species do not appear to be as reliable as the results for red snapper, probably in large part due to their lower abundances, but also due to reasons unique for each species. Vermilion snapper are extremely patchy, to the point that the negative binomial error adequate for red snapper may not be appropriate for vermilion. Because of doubts about the reliability of the annual estimates for these species from the SEDAR7 model, a delta distribution-based version of the Bayesian approach was introduced, and a fully mixed effects model ("Model 3") considered but not ultimately not used for red snapper was resurrected. There is some evidence that the delta implementation may be underestimating bycatch, and the frequencies of occurrence of for vermilion and greater amberjack are so low that one has to be suspicious about results of the CPUE portion of the delta distribution analysis. Model 3 central tendencies tended to be intermediate between the SEDAR7 and delta results, but the uncertainty estimates were enormous. Table Cf 2.2.1 provides some summary statistics of the performances of the models when applied to the SEDAR9 species, and compare them with the more successful situation for red snapper. In view of the unrealistic results that cropped up for all three SEDAR9 species, the DW recommends setting aside the estimates of inter-annual variation in favor of estimating an overall average, and then constructing wide uncertainty intervals to incorporate estimation error within models, variation among model choices, and inter-annual variation. Working at a resolution below an annual time step is not recommended.

The simplest statistic from SEDAR9-DW-26 (average CPUE in all observer trips times an approximate recent effort level) is recommended as the estimate of central tendency. It was not possible to partition the bycatch estimates by age as per SEDAR7-AW-20, as only a handful of fish for these 3 species have been measured across all the observer studies.

There are a number of options to be considered for providing estimates of central tendency and variation. These options will be developed, along with further exploration of why the SEDAR7 model performed as poorly as it did for these less abundant species. Results will be reported in a paper for the Assessment Workshop.

3.2.3 Size composition

The committee did not review the size composition of vermilion snapper, because the 2001 assessment (Porch and Cass-Calay 2001) concluded that there was little relationship between size and age, and therefore, the data are not useful to construct catch-at-age tables.

Table 2.1 Commercial landings (pounds whole weight) of vermilion snapper from Gulf of Mexico waters

	TX	LA	MS	AL	wFL	eFL	total
1963					53,280		53,280
1964					57,165		57,165
1965					54,168		54,168
1966					24,087		24,087
1967					51,060		51,060
1968					120,435		120,435
1969					116,439		116,439
1970					127,761		127,761
1971					139,083		139,083
1972					126,873		126,873
1973					190,476		190,476
1974					195,471		195,471
1975					389,277		389,277
1976					306,471		306,471
1977					528,500		528,500
1978					449,813		449,813
1979					438,884		438,884
1980					308,557		308,557
1981					361,864		361,864
1982					397,707		397,707
1983				8,756	561,748		570,504
1984		394,672	297,071	52,040	694,406		1,438,189
1985	38,546	304,502	171,965	128,567	834,952		1,478,532
1986	120,954	450,460	192,447	111,986	873,600		1,749,447
1987	42,386	611,823	188,833	61,106	701,257		1,605,405
1988	59,901	634,313	152,775	9,471	697,945	137	1,554,542
1989	62,129	577,849	99,364	10,434	908,932	114	1,658,822
1990	115,204	812,918	141,804	20,048	1,070,546	294,352	2,454,872
1991	40,130	603,017	116,970	6,629	1,028,279		1,795,025
1992	140,660	652,377	165,103	18,855	1,290,863	59	2,267,916
1993	304,283	646,397	116,005	22,373	1,630,247	235	2,719,540
1994	272,331	748,391	129,676	23,326	1,465,430	79	2,639,233
1995	221,885	376,400	104,614	3,766	1,471,368	8	2,178,040
1996	160,990	430,133	92,527	4,961	1,138,579	93	1,827,282
1997	296,266	614,185	130,116	6,841	1,078,230	176	2,125,814
1998	332,869	457,830	137,926	5,040	798,767	206	1,732,638
1999	313,901	740,949	60,264	16,113	851,105		1,982,332
2000	245,972	503,541	36,055	12,663	661,708	5	1,459,944
2001	236,721	600,561	37,781	26,710	813,310		1,715,084
2002	216,225	755,593	38,726	28,060	969,974		2,008,578
2003	188,873	1,052,991	47,052	35,765	1,091,067		2,415,748
2004	313,276	918,813	17,543	65,920	818,831		2,134,383

Table 2.2 Commercial landings (pounds whole weight) of vermilion snapper by gear and region.

	handline+		longline		
	west US Gulf	east US Gulf	west US Gulf	east US Gulf	total
1963	22,533	30,747			53,280
1964	23,532	33,633			57,165
1965	20,757	33,411			54,168
1966	6,660	17,427			24,087
1967	15,762	35,298			51,060
1968	50,283	70,152			120,435
1969	27,084	89,355			116,439
1970	44,400	83,361			127,761
1971	48,063	91,020			139,083
1972	46,509	80,364			126,873
1973	54,945	135,531			190,476
1974	66,822	128,649			195,471
1975	109,335	279,942			389,277
1976	60,495	245,976			306,471
1977	195,126	333,375			528,500
1978	163,261	286,552			449,813
1979	220,445	218,438			438,884
1980	148,455	159,658		444	308,557
1981	115,663	231,522	4,549	10,131	361,864
1982	146,490	239,367	4,662	7,188	397,707
1983	161,754	377,712	7,102	23,936	570,504
1984	848,288	532,675	41,392	15,834	1,438,189
1985	737,600	672,257	53,910	14,765	1,478,532
1986	939,041	689,625	119,597	1,184	1,749,447
1987	1,003,433	534,518	62,662	4,792	1,605,405
1988	991,713	492,997	54,372	15,460	1,554,542
1989	1,002,816	481,705	59,609	114,692	1,658,822
1990	962,643	1,489,581	613	2,035	2,454,872
1991	808,348	969,399	1,683	15,594	1,795,025
1992	1,036,278	1,217,900	12,352	1,386	2,267,916
1993	1,024,203	1,667,549	24,197	3,591	2,719,540
1994	1,040,183	1,582,072	13,494	3,485	2,639,233
1995	654,242	1,506,085	14,700	3,013	2,178,040
1996	651,873	1,166,437	5,545	3,426	1,827,282
1997	1,072,584	1,040,331	8,120	4,779	2,125,814
1998	895,269	807,987	6,422	22,959	1,732,638
1999	1,098,219	866,821	6,959	10,333	1,982,332
2000	758,230	699,209	709	1,796	1,459,944
2001	915,733	791,599	1,314	6,437	1,715,084
2002	997,300	1,008,662	432	2,183	2,008,578
2003	1,260,897	1,153,574	660	618	2,415,748
2004	1,218,992	903,434	11,004	953	2,134,383

Table 2.3. Annual estimates of vermilion snapper total discards for the Gulf of Mexico handline fishery.

YEAR	Estimate of Total Number of Discards
1997	16,994
1998	75,589
1999	80,293
2000	80,451
2001	77,930
2002	152,694
2003	38,479
2004	71,370

Table 2.4 Summary of unexpected levels and ranges for shrimp fleet bycatch estimates for the SEDAR9 species from SEDAR9-DW-26, compared with similar analyses for red snapper, and some supporting statistics.

	Vermilion Snapper	Gray Triggerfish	Greater Amberjack	Red Snapper
average CPUE x approx effort	7.7M	3.8M	1.9k	27.6M
SEDAR7 model results				
median of annual medians	36M	8.3M	140k	26.3M
range of annual medians	530x	130x	88x	15x
range of annual 95% ci ranges	18x-1200x	4.9x-67x	18x-100x	1.7x-29x
Delta model results				
median of annuals	1.6M	2.2m	24k	13M
range of annual medians	160x	140x	78x	6x
range of annual 95% ci ranges	2.5x-700x	3.9x-360x	53x-1100x	1.4x-6.7x
Model 3 results				
median of annuals	3.8M	1.7M	73k	14M
range of annual medians	93x	160x	70x	19x
range of annual 95% ci ranges	23000x-38000x	810x-1300x	660x-1200x	190x-270x
frequency of occurrence in C	4%	9%	0.07%	43%
frequency of occurrence in R	2%	8%	0.50%	30%
frequency of occurrence in B	5%	0	0	55%
number of stations				
C	8460	2863	2866	9943
R	26487	26983	26487	26486
B	4920	402	402	8130

C refers to observer data for commercial shrimp tows without BRDs
B refers to observer data for commercial shrimp tows with BRDs
R refers to research vessel (Oregon II) tows

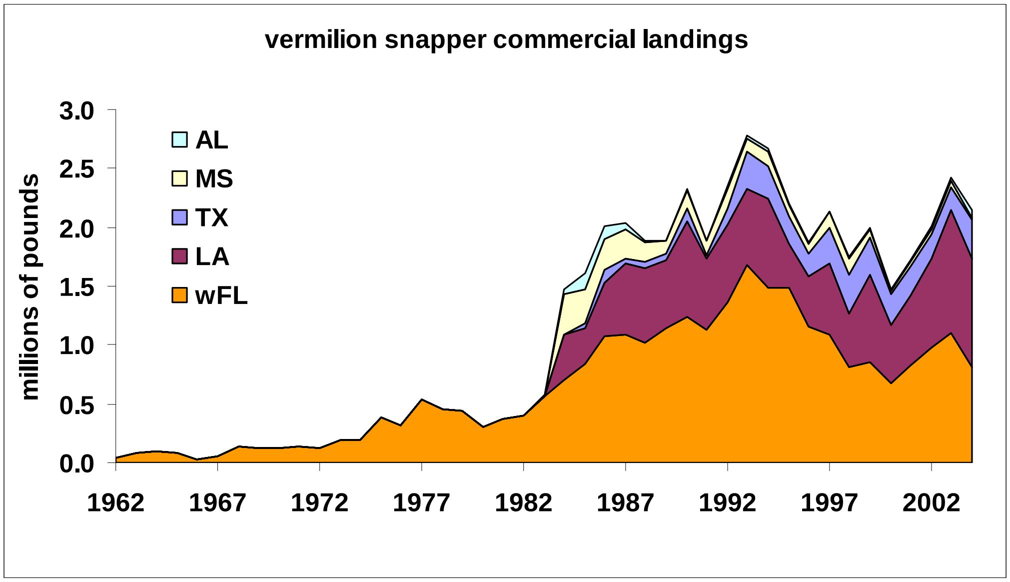


Figure 2.1 Commercial landings of vermilion snapper by state from 1962-2004.

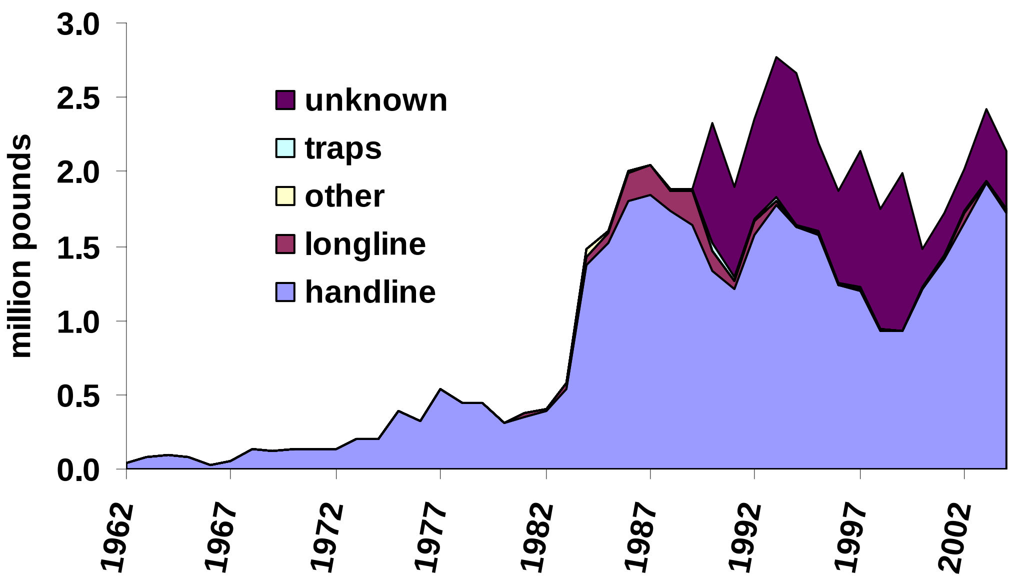


Figure 2.2 Commercial landings of vermilion snapper by gear.

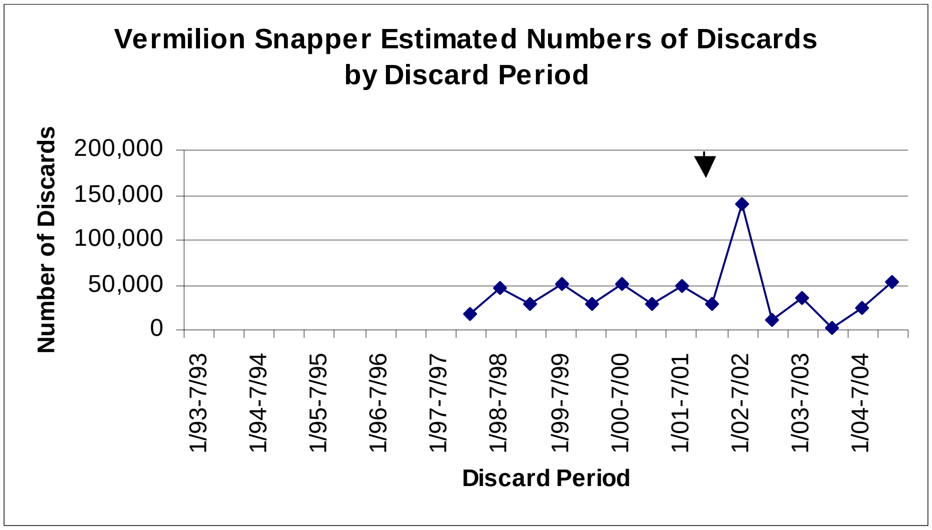


Figure 2.3. Estimated numbers of vermilion snapper discard, by discard period.

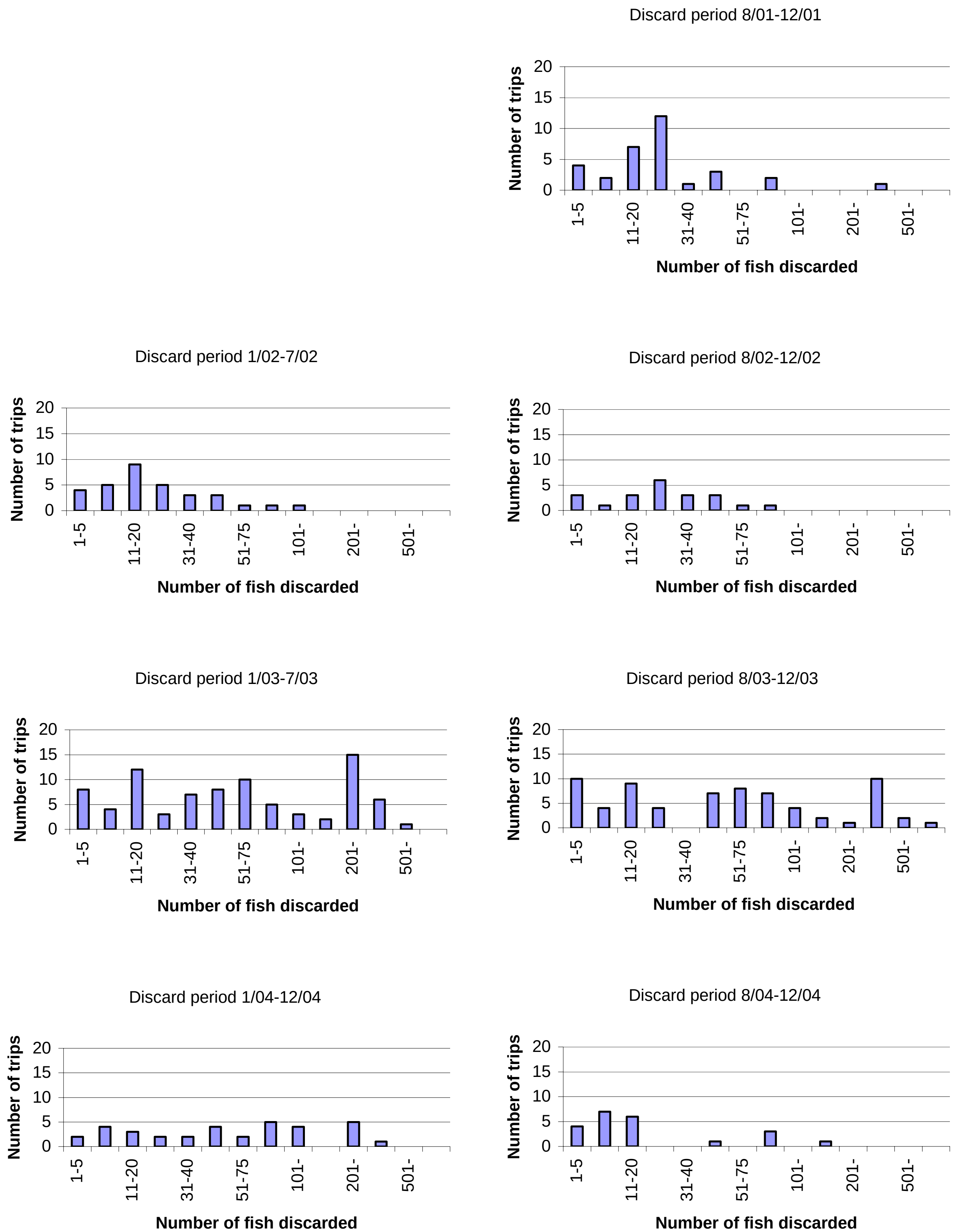


Figure 2.4. Frequency of vermilion snapper trips that reported discards by number of fish discarded and discard period.

4. Recreational Statistics

The recreational fishery statistics for vermilion snapper are collected by three separate surveys: Marine Recreational Fishing Statistical Survey (MRFSS), Texas Parks and Wildlife Department (TPWD) and the NMFS Beaufort Headboat Survey (HB). MRFSS has captured statistics on shore based, charter boat and private/rental boat fishing since 1981 from Florida through Louisiana. MRFSS included headboats in the survey from 1981-1985. In the Gulf of Mexico the HB began in 1986 covering the west coast of Florida through Texas. TPWD has collected recreational fishing statistics from 1981 – 1985 and since 1986 for all fishing modes except "offshore" headboats in the state of Texas.

The Recreational Statistics working group, henceforth referred to as "the group", expressed concern over the accuracy of the MRFSS data for the reef fish species, but the group agrees that for this species the recreational fishery landings contribute a large proportion of the overall catch. The group's concern centers on the low number of intercepted fish that is used in conjunction with the fishing effort estimates from the phone survey to estimate total catch (e.g., small anomalies in the data can be expanded to large anomalies). Another concern is over species identification of the B1 and B2 (not seen by interviewer) catches. Many fishermen are known to call vermilion snapper "red snapper", which in turn may cause problems with species assignation for the B1 and B2 catches.

DW Recommendation: The MRFSS and TPWD data are the best available data and cannot be ignored. The landings have CVs associated with them that will capture the high level of uncertainty and be incorporated into the assessment model. The previous assessment used data from 1986-1999, although recreational statistics are available back through 1981. The group recommends the use of all available data 1981-2004.

DW Recommendation: Staff of NMFS SEFSC are developing methodology by which to fill missing recreational landings information. The missing landings are most commonly from the first wave in 1981 and Texas for all years. The group decided to accept the methodology from the SEFSC staff (see Appendix 1). The group was not able to review the methodology at the time of the data workshop.

4.1 Recreational landings

4.1.1 MRFSS

The MRFSS program reports fish landed and observed (A), landed but not observed, used for bait, filleted, or discarded dead. (B1) and released alive (B2). Estimated vermilion snapper landed (dead fish; A+B1) by the recreational sector are shown in Table 3.1(a-d). Landings are summarized by year, state and mode. Most vermilion snapper were landed by private boats and charter boats operating off Florida and Alabama. Very few vermilion snapper are landed by recreational fishers operating off Louisiana and Texas.

Landings from shore-based fishing mode have been reported (Table 3.1d), but the group felt the estimates from shore mode were not likely to be valid.

DW Recommendation*:* Omit shore based landings, because it was felt that the fishing mode may have been misidentified, and vermilion snapper being caught from the shore is highly unlikely. If the fishing mode was misidentified the expansion factor for fishing effort from shore mode would greatly inflate any landings of vermilion snapper classified as shore mode.

DW Recommendation*:* The group felt that identification of vermilion snapper is relatively easy and the landings of unidentified snapper would most likely be other species of snapper. The group decided to disregard the unidentified snapper landings.

4.1.2 TPWD

Texas Parks and Wildlife Department (TPWD) provides estimates of recreational landings off the state of Texas. These are summarized by year and mode in Table 3.2. The largest reported landings are from headboats prior to 1986. No landings by headboats are reported after 1985 because the NMFS Beaufort Headboat Survey took over the headboat sampling program at that time. Other TPWD landings estimates are very small. This is likely due to the predominance of near-shore samples in the TPWD data. TPWD does not provide estimates of fish discarded dead or released alive.

4.1.3 Headboat Survey

Since 1986, the NMFS Beaufort Headboat Survey has provided estimates of fish landed by headboats. These are summarized by year and region in Table 3.3. The majority of vermilion snapper landed by headboats were landed off NW Florida and Alabama. A smaller, but substantial fraction, were landed off Texas. Headboat landings off Louisiana and Mississippi are negligible. The HB Survey does not currently provide estimates of fish discarded dead or released alive, although discards will be estimated in the near future.

DW Recommendation: The landings of areas 12 and 17 should not be included in the Gulf of Mexico analysis. The group felt that better than 99% of the trips in area 12 and 17 occur in Atlantic jurisdiction waters. There was no evidence of mixing of the Atlantic and Gulf of Mexico stocks in that area. Table 4 includes the Headboat Survey landings to be used in the assessment.

4.2 Recreational discards

Only the MFRSS program reports fish discarded or released by the recreational sector. (although HB discards are being compiled as of 2005). Discard estimates from the MRFSS program are summarized in Table 3.4(a-c).

DW Recommendation: To estimate the discard fraction, the group recommends the use of the ratio of releases (B2) to total catch (A+B1+B2) be calculated for the MRFSS charter boat mode only. The group felt that charter boat and headboat fishing are most similar and the rate of released fish would be most alike. Private boat fishing would not be the same as the "for-hire" sector (Tables 3a-c).

4.3 Length samples

Although numerous recreational length samples are available for vermilion snapper, the group did not review the length samples available from the different data sources because of the lack of relationship between size and age of the fish. However, this data will be used to estimate the average weight of vermilion snapper by year, mode and area to convert landings estimates in numbers to landings in weight.

Table 3.1a MRFSS A+B1 landings (numbers of fish) for the charter boat mode by year and state.

CHARTER BOAT MODE (MODE 3)

YEAR	AL	CV	FL	CV	LA	CV	MS	CV
1981	0	0.00	0	0.00	0	0.00	0	0.00
1982	0	0.00	0	0.00	0	0.00	0	0.00
1983	0	0.00	0	0.00	0	0.00	0	0.00
1984	0	0.00	0	0.00	0	0.00	0	0.00
1985	0	0.00	0	0.00	0	0.00	0	0.00
1986	66,037	1.00	281,844	0.31	1,228	0.98	0	0.00
1987	51,369	1.29	305,963	0.45	2,317	1.33	0	0.00
1988	32,897	0.88	335,622	0.22	0	0.00	0	0.00
1989	58,848	0.90	167,315	0.25	0	0.00	0	0.00
1990	299,703	0.77	217,646	0.32	1,970	1.35	621	1.46
1991	209,947	0.73	382,884	0.23	6,377	1.01	0	0.00
1992	220,718	0.84	217,331	0.19	1,337	0.93	0	0.00
1993	236,741	0.67	267,908	0.13	49	1.36	158	1.41
1994	118,611	0.76	283,341	0.15	4,031	1.14	432	1.29
1995	181,589	0.72	481,653	0.26	1,842	1.20	0	0.00
1996	158,674	0.71	94,421	0.27	380	1.60	0	0.00
1997	175,040	0.73	100,715	0.27	271	1.54	67	1.62
1998	95,782	0.24	44,251	0.08	36	0.96	0	0.00
1999	63,476	0.19	99,206	0.07	384	0.41	0	0.00
2000	19,000	0.25	111,117	0.08	0	0.00	0	0.00
2001	52,196	0.22	113,454	0.08	0	0.00	0	0.00
2002	26,640	0.20	83,744	0.07	3,777	0.74	0	0.00
2003	32,986	0.22	84,644	0.07	1,611	0.36	0	0.00
2004	83,639	0.21	159,500	0.05	16,356	0.76	0	0.00

Table 3.1b MRFSS A+B1 landings (numbers of fish) for the private boat mode by year and state.

PRIVATE BOAT MODE (MODE 4)

YEAR	AL	CV	FL	CV	LA	CV	MS	CV
1981	24,082	0.42	60,142	0.34	23,793	0.51	0	0.00
1982	0	0.00	954	0.47	11,749	0.76	0	0.00
1983	0	0.00	0	0.00	17,909	0.50	0	0.00
1984	22,056	0.74	0	0.00	489	0.75	0	0.00
1985	0	0.00	241,938	0.47	22,940	0.53	0	0.00
1986	0	0.00	78,393	0.33	0	0.00	0	0.00
1987	11,071	0.46	133,831	0.36	0	0.00	0	0.00
1988	72,824	0.51	226,466	0.32	0	0.00	0	0.00
1989	48,224	0.44	132,724	0.34	0	0.00	0	0.00
1990	96,682	0.43	18,930	0.60	0	0.00	0	0.00
1991	20,608	0.38	28,262	0.51	0	0.00	10,646	1.00
1992	142,882	0.16	117,903	0.23	17,095	0.41	431	0.60
1993	105,624	0.21	69,894	0.32	1,056	0.15	914	0.49
1994	50,747	0.21	39,131	0.39	0	0.00	0	0.00
1995	67,719	0.28	59,440	0.24	763	1.01	0	0.00
1996	4,611	0.57	31,924	0.37	1,656	0.64	0	0.00
1997	55,523	0.46	719	1.00	3,952	0.62	841	0.98
1998	9,031	0.34	3,121	0.64	2,461	0.71	0	0.00
1999	57,278	0.30	18,567	0.34	1,868	0.67	688	0.75
2000	5,582	0.44	22,561	0.42	0	0.00	0	0.00
2001	81,179	0.30	149,384	0.32	6,150	0.70	0	0.00
2002	55,589	0.32	122,814	0.31	0	0.00	0	0.00
2003	31,621	0.44	138,735	0.24	5,426	0.49	693	0.77
2004	69,493	0.45	142,697	0.22	2,520	0.68	3,755	0.90

Table 3.1c MRFSS A+B1 landings (numbers of fish) for the combined charterboat/headboat mode by year and state.

COMBINED CHARTER+HEAD BOAT MODE (MODE 5)

YEAR	AL	CV		FL	CV		LA	CV		MS	CV
1981	6,144	1.15		27,727	0.78		0	0.00		0	0.00
1982	74,259	1.24		668,552	0.76		38,352	1.20		0	0.00
1983	31,917	1.05		122,617	0.44		0	0.00		0	0.00
1984	185,302	0.85		88,863	0.76		0	0.00		0	0.00
1985	0	0.00		119,781	0.72		13,740	1.16		0	0.00
1986	0	0.00		0	0.00		0	0.00		0	0.00
1987	0	0.00		0	0.00		0	0.00		0	0.00
1988	0	0.00		0	0.00		0	0.00		0	0.00
1989	0	0.00		0	0.00		0	0.00		0	0.00
1990	0	0.00		0	0.00		0	0.00		0	0.00
1991	0	0.00		0	0.00		0	0.00		0	0.00
1992	0	0.00		0	0.00		0	0.00		0	0.00
1993	0	0.00		0	0.00		0	0.00		0	0.00
1994	0	0.00		0	0.00		0	0.00		0	0.00
1995	0	0.00		0	0.00		0	0.00		0	0.00
1996	0	0.00		0	0.00		0	0.00		0	0.00
1997	0	0.00		0	0.00		0	0.00		0	0.00
1998	0	0.00		0	0.00		0	0.00		0	0.00
1999	0	0.00		0	0.00		0	0.00		0	0.00
2000	0	0.00		0	0.00		0	0.00		0	0.00
2001	0	0.00		0	0.00		0	0.00		0	0.00
2002	0	0.00		0	0.00		0	0.00		0	0.00
2003	0	0.00		0	0.00		0	0.00		0	0.00
2004	0	0.00		0	0.00		0	0.00		0	0.00

Table 3.1d. MRFSS A+B1 landings (numbers of fish) for the shore mode by year and state.

SHORE MODE (MODE 1)

YEAR	AL	CV		FL	CV		LA	CV		MS	CV
1981	0	0.00		0	0.00		0	0.00		0	0.00
1982	0	0.00		0	0.00		0	0.00		0	0.00
1983	0	0.00		0	0.00		0	0.00		0	0.00
1984	0	0.00		0	0.00		0	0.00		0	0.00
1985	0	0.00		903	1.00		0	0.00		0	0.00
1986	0	0.00		0	0.00		0	0.00		0	0.00
1987	0	0.00		0	0.00		0	0.00		0	0.00
1988	0	0.00		0	0.00		0	0.00		0	0.00
1989	0	0.00		0	0.00		0	0.00		0	0.00
1990	5,916	0.54		0	0.00		0	0.00		0	0.00
1991	2,665	0.61		131,286	0.59		0	0.00		0	0.00
1992	0	0.00		0	0.00		0	0.00		0	0.00
1993	0	0.00		0	0.00		0	0.00		0	0.00
1994	0	0.00		0	0.00		0	0.00		0	0.00
1995	0	0.00		0	0.00		0	0.00		0	0.00
1996	0	0.00		0	0.00		0	0.00		0	0.00
1997	0	0.00		0	0.00		0	0.00		0	0.00
1998	0	0.00		0	0.00		0	0.00		0	0.00
1999	0	0.00		0	0.00		0	0.00		0	0.00
2000	0	0.00		0	0.00		0	0.00		0	0.00
2001	0	0.00		0	0.00		0	0.00		0	0.00
2002	0	0.00		0	0.00		0	0.00		0	0.00
2003	0	0.00		0	0.00		0	0.00		0	0.00
2004	0	0.00		0	0.00		0	0.00		0	0.00

Table 3.2 TPWD landings in numbers by mode. HB mode was not samples after 1985

YEAR	HB	MODE CB	PB	TOTAL
1983	53,141		6	53,147
1984	70,271		86	70,357
1985				
1986			56	56
1987			292	292
1988			749	749
1989			229	229
1990		16		16
1992			42	42
1993			731	731
1994		18	238	256
1995			517	517
1996			249	249
1997		556	3,062	3,618
1998		236	654	890
1999		302	1,212	1,514
2000		384	953	1,337
2001		4,729	627	5,356
2002			2,092	2,092
2003		116	1,482	1,598

Table 3.3. Headboat landings (number of fish) by area.

	AREA								
	Dry Tortugas Gulf Vessels	SW FL	FL Middle Grounds	NW FL & AL	LA	NE TX	Central TX	South TX	Total
YEAR	18	21	22	23	24	25	26	27	ALL
1986	28	2,645	26,279	488,750	792	36,729	13,555	2,215	570,993
1987		3,921	11,289	458,594	54	36,052	16,343	4,212	530,465
1988		5,984	9,111	641,962	1,591	34,985	13,027	1,121	707,781
1989		8,967	14,588	355,736	308	31,344	32,293	10,646	453,882
1990	308	8,052	15,058	411,767	1,272	30,122	46,526	25,547	538,652
1991		5,093	8,844	409,086	787	15,802	50,564	16,182	506,358
1992	10	11,424	8,741	545,357	3,960	31,778	40,167	1,098	642,535
1993	22	15,442	16,480	411,036	3,502	49,257	20,367	3,480	519,586
1994	22	11,354	18,783	344,653	3,165	75,280	32,791	6,684	492,732
1995	22	6,028	6,632	320,827	1,097	59,236	37,978	3,947	435,767
1996		9,775		209,416	1,546	40,740	28,129	4,540	294,146
1997		850	436	200,182	183	42,791	32,094	1,437	277,973
1998		2,720	6,000	87,633	80	36,450	23,350	1,920	158,153
1999		1,986	5,679	130,005	544	17,249	23,218	289	178,970
2000		717	1,347	129,563	323	26,057	16,132	5	174,144
2001		2,315	1,239	145,148	355	26,742	37,815	2,179	215,793
2002		2,944	2,448	141,498	355	31,580	37,117	1,366	217,308
2003		5,912	1,432	208,341	389	37,171	41,122	4,852	299,219
2004		4,671	894	230,608	N/A**	55,340	42,137	3,922	337,572

Table 3.4a. Numbers of fish released alive (B2) for the charter boat mode by year and state.

CHARTER BOAT MODE (MODE 3)

YEAR	AL	CV		FL	CV		LA	CV		MS	CV
1981	0	0.00		0	0.00		0	0.00		0	0.00
1982	0	0.00		0	0.00		0	0.00		0	0.00
1983	0	0.00		0	0.00		0	0.00		0	0.00
1984	0	0.00		0	0.00		0	0.00		0	0.00
1985	0	0.00		0	0.00		0	0.00		0	0.00
1986	0	0.00		8,399	0.57		0	0.00		0	0.00
1987	2,166	1.47		843	0.73		0	0.00		0	0.00
1988	0	0.00		84,076	0.35		0	0.00		0	0.00
1989	0	0.00		16,429	0.54		0	0.00		0	0.00
1990	13,282	1.19		16,061	0.59		0	0.00		0	0.00
1991	4,017	0.91		15,232	0.47		0	0.00		0	0.00
1992	15,252	0.95		37,914	0.37		0	0.00		0	0.00
1993	68,445	0.82		61,286	0.33		0	0.00		236	1.62
1994	12,323	0.90		18,968	0.46		0	0.00		884	1.39
1995	28,271	0.95		124,043	0.24		0	0.00		0	0.00
1996	25,229	0.81		3,683	0.49		0	0.00		0	0.00
1997	6,150	0.90		14,708	0.73		0	0.00		0	0.00
1998	9,485	0.41		4,553	0.34		0	0.00		0	0.00
1999	904	0.60		8,847	0.22		0	0.00		0	0.00
2000	569	0.50		7,516	0.25		0	0.00		0	0.00
2001	919	0.80		9,508	0.33		0	0.00		0	0.00
2002	1,450	0.62		1,659	0.32		0	0.00		0	0.00
2003	189	1.00		3,646	0.27		0	0.00		0	0.00
2004	10,477	0.40		17,990	0.12		0	0.00		0	0.00

Table 3.4b. Numbers of fish released alive (B2) for the private boat mode by year and state.

PRIVATE BOAT MODE (MODE 4)

YEAR	AL	CV	FL	CV	LA	CV	MS	CV
1981	0	0.00	0	0.00	0	0.00	0	0.00
1982	0	0.00	0	0.00	0	0.00	0	0.00
1983	0	0.00	0	0.00	0	0.00	0	0.00
1984	0	0.00	0	0.00	0	0.00	0	0.00
1985	0	0.00	0	0.00	5,066	1.00	0	0.00
1986	0	0.00	54,123	0.37	0	0.00	0	0.00
1987	0	0.00	15,772	0.59	0	0.00	0	0.00
1988	0	0.00	25,277	0.39	0	0.00	0	0.00
1989	0	0.00	36,365	0.51	0	0.00	0	0.00
1990	0	0.00	2,561	1.00	0	0.00	0	0.00
1991	12,838	0.55	112,878	0.35	0	0.00	0	0.00
1992	5,197	0.42	104,702	0.28	0	0.00	1,092	0.59
1993	41,650	0.39	115,756	0.27	0	0.00	18,171	0.60
1994	29,950	0.46	31,831	0.31	0	0.00	0	0.00
1995	10,274	0.52	84,522	0.31	10,890	1.00	0	0.00
1996	2,793	0.62	53,730	0.29	0	0.00	1,340	0.90
1997	8,972	0.72	3,592	0.61	774	1.00	0	0.00
1998	3,863	0.44	6,597	0.53	0	0.00	0	0.00
1999	23,530	0.79	13,050	0.36	6,669	0.67	76	1.00
2000	3,543	0.69	10,712	0.44	2,405	1.00	0	0.00
2001	6,080	0.54	33,003	0.38	0	0.00	0	0.00
2002	4,859	0.90	71,475	0.27	0	0.00	462	1.00
2003	548	1.00	67,176	0.23	0	0.00	0	0.00
2004	12,688	0.76	74,775	0.29	0	0.00	0	0.00

Table 3.4c. Numbers of fish released alive (B2) for the combined charter/head boat modes by year and state.

COMBINED CHARTER+HEAD BOAT MODE (MODE 5)

YEAR	AL	CV	FL	CV	LA	CV	MS	CV
1981	0	0.00	0	0.00	0	0.00	0	0.00
1982	0	0.00	3,968	1.49	0	0.00	0	0.00
1983	592	1.46	27,902	0.63	0	0.00	0	0.00
1984	724	1.36	13,598	0.72	0	0.00	0	0.00
1985	0	0.00	17,068	0.94	0	0.00	0	0.00
1986	0	0.00	0	0.00	0	0.00	0	0.00
1987	0	0.00	0	0.00	0	0.00	0	0.00
1988	0	0.00	0	0.00	0	0.00	0	0.00
1989	0	0.00	0	0.00	0	0.00	0	0.00
1990	0	0.00	0	0.00	0	0.00	0	0.00
1991	0	0.00	0	0.00	0	0.00	0	0.00
1992	0	0.00	0	0.00	0	0.00	0	0.00
1993	0	0.00	0	0.00	0	0.00	0	0.00
1994	0	0.00	0	0.00	0	0.00	0	0.00
1995	0	0.00	0	0.00	0	0.00	0	0.00
1996	0	0.00	0	0.00	0	0.00	0	0.00
1997	0	0.00	0	0.00	0	0.00	0	0.00
1998	0	0.00	0	0.00	0	0.00	0	0.00
1999	0	0.00	0	0.00	0	0.00	0	0.00
2000	0	0.00	0	0.00	0	0.00	0	0.00
2001	0	0.00	0	0.00	0	0.00	0	0.00
2002	0	0.00	0	0.00	0	0.00	0	0.00
2003	0	0.00	0	0.00	0	0.00	0	0.00
2004	0	0.00	0	0.00	0	0.00	0	0.00

5. Fishery-Dependent Indices

5.1 Commercial Fishery Catch Rates

The three fisheries independent catch rate indices are summarized in Figure 4.1.

5.1.1 Commercial Handline

Several abundance indices were developed for Gulf of Mexico vermilion snapper using data from commercial logbooks (SEDAR9-DW-05). Trips were limited to those that fished in a single statistical area within the Gulf of Mexico using handlines or electric reels (151,655 trips). The two gear types were considered equivalent. The indices were constructed for the period 1993-2004 because all permitted commercial vessels were required to report during this period. Vermilion snapper occurred on 27% of the 151,655 trips. The Stephens and MacCall (2004) species association approach was used to limit the input data to those trips that were more likely to catch vermilion snapper based on the species composition of the trip. This approach selected 41,255 trips for consideration, and vermilion snapper were landed on 30,471 (74%). Using these trips, delta-lognormal indices were constructed for the Gulf of Mexico, and the eastern and western regions. All indices indicated declining catch rates from 1993-2000. However, the index results differ during the period 2000-2004. The gulf-wide index indicates a slow increase in catch rates from 2000-2004. The eastern index indicates that catch rates have not improved off FL, AL and MS since 2000, while the western index suggests substantial improvement in catch rates of LA and TX.. A second set of indices were constructed that did not exclude trips based on species composition. These indices are very similar to those constructed using the species composition approach. None of the commercial indices directly considered the effect of the increase in minimum legal size that occurred in January 1998 (8” to 10”). Since the commercial data does not include discards, the group recommended that the indices be reconstructed breaking the data into two time periods at the date of the increase in the minimum size limit.

5.2 Recreational Fishery Catch Rates

5.2.1 Marine Recreational Fisheries Statistics Survey Catch Rates

Abundance indices were developed for Gulf of Mexico vermilion snapper (SEDAR9-DW-04) using data from the Marine Recreational Fisheries Statistics Survey (MRFSS). The dataset constructed for these analyses contained all hook and line trips from FL and AL that fished in areas >3 miles offshore. Other trips were excluded because they very rarely observe vermilion snapper. The MRFSS indices were constructed for the period 1986 to 2004. Trips before 1986 were excluded because vermilion snapper were very rarely reported, and as a result, the GLM sample designs were unbalanced with regard to the factors (YEAR, STATE, Red Snapper REC_SEASON and MODE (CB, PB)). Vermilion snapper occurred on 3.8% of 118,725 trips (as either landed or discarded animals A+B1+B2). Therefore there was concern that inclusion of all fishing trips would contaminate the CPUE series by including trips that fished outside of vermilion snapper “habitat” and by violating the statistical assumptions of the binomial component of the delta-lognormal model. Therefore, the Stephens and MacCall (2004) species association approach was used to identify trips that were more likely to observe vermilion snapper based on the composition of other species observed. This approach selected 4,480 trips for consideration of which 2,788 observed vermilion snapper (62%) Using these trips, a delta-lognormal model was constructed. The resulting standardized index indicates catch rates were relatively high during 1990-1995, but declined substantially thereafter, and remain low throughout 1997-2004. A second index was constructed that did not exclude trips based on species composition. This index is very similar one constructed using the species composition approach. Neither index directly considered the effect of the increase in minimum legal size that occurred in January 1998 (8" to 10"), or the 1997 implementation of an aggregate bag limit. However, the group agreed that because the MRFSS dataset includes discarded and released vermilion snapper, management decisions should not adversely affect the quality of the index.

5.2.2 Headboat Survey Catch Rates

An abundance index was developed (SEDAR9-DW-29) for Gulf of Mexico vermilion snapper using data from the NMFS Southeast Zone Headboat Survey. This index spanned from 1986 to 2004, with large sample sizes each year. Additionally, vessels could be tracked individually. Vermilion snapper was the most common species in the Gulf of Mexico headboat dataset and occurred in 38% of trips. Based upon the geographic distribution of average vermilion snapper catch rates, two zones (EAST and WEST, Figure INDEX-??) having relatively high catch rates were defined. The analysis was restricted to data from these two zones in order to reduce variance and to minimize the potential biases of year-to-year fluctuations in the proportion of total effort occurring within these zones. For similar reasons, the Stephens and MacCall (2004) species association approach was used to identify trips that were likely to catch vermilion snapper based on the composition of other species landed. Furthermore, the data were restricted to include only records from vessels making at least 30 of these trips during the time period. Based upon headboat data size frequency distributions, it appeared likely that the imposition of a 10 inch TL minimum size limit in January 1990 likely influenced discard rates, which are not recorded in the headboat survey data. Also, the aggregate 20 fish bag limit was instituted in January 1997, although the impact of this was expected to be lower. As a consequence, the EAST and WEST zone data sets were each split into two time periods (1986-1997 and 1998-2004) within which discard rates were expected to be relative consistent from year to year. For each set of data, a delta-lognormal model was constructed considering the following factors: year, month, season, area, vessel, time of day, trip duration, and whether or not the red snapper season was open (since this could influence fisher behavior). The Working Group recommended that the indices could be considered for use in the assessment, subject to revisions described in section 4.3.

5.3 Recommendations

5.3.1 Indices to be considered for use in the assessment

As a general recommendation, the indices recommended for use from each fishery (pending the expected revisions to the analyses) are those indices which employed the

Stephens and MacCall (2004) approach to subsetting the data, calculated separately for the Eastern and Western Gulf of Mexico. Gulf-wide indices should also be provided.

5.3.2 Data and/or analysis revisions

Due to the expected effect on discard rates caused by changing minimum legal size limits, the commercial handline indices should be constructed separately for the periods before and after the implementation of the 10” minimum size limit.

5.4 References:

Stephens, A. and A. MacCall. 2004. A multispecies approach to subsetting logbook data for purposes of estimating CPUE. Fisheries Research 70 (2004), 299–310.

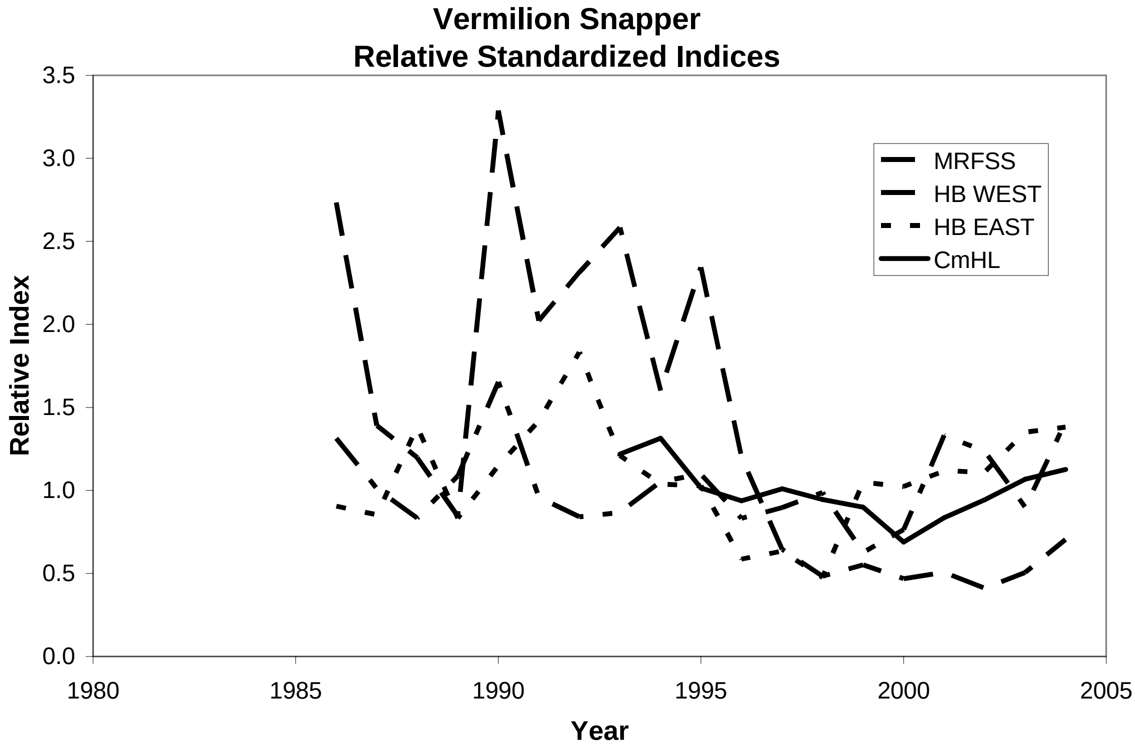


Figure 4.1 Relative standardized catch rate indices constructed using fisheries-dependent data.

6. Fishery-Independent Indices

In preparation for the SEDAR, four fishery independent surveys were analyzed and indices of relative abundance developed. These were the Southeast Area Monitoring and Assessment Program (SEAMAP) shrimp/bottomfish surveys and their predecessors, the SEAMAP ichthyoplankton surveys, the SEAMAP reef fish survey, and the small pelagics trawl survey. The small pelagics data may be useful for extended distributional information, but is not a rigorous time series, and is not considered further here. The ichthyoplankton and reef fish surveys are intended to index spawning stock size. The trawl indexes are intended to index new recruitment.

The three fisheries independent catch rate indices are summarized in Figure 5.1.

6.1 SEAMAP Ichthyoplankton Surveys:

Examination of proportion occurrence and nominal mean abundance of vermilion snapper larvae captured during all SEAMAP surveys indicated that larvae consistently occurred most frequently and in highest abundance in bongo net samples during the annual Fall Plankton survey. This survey coincides with both the time and location of peak vermilion snapper spawning Gulf-wide (in U.S. waters), namely late summer months over the continental shelf. The time series of larval data available for the upcoming assessment includes the years, 1986-2002 with 1998 observations excluded due to curtailed sampling that year. Geographic coverage during the fall plankton survey includes the west Florida shelf where vermilion snapper larvae are present in moderate to high abundances. Catches of vermilion snapper larvae from sampling during the summer and fall shrimp/bottomfish surveys were not included in estimates of annual abundance because these surveys do not extend east of Mobile Bay, Alabama and, therefore, do not adequately sample a large portion of the vermilion snapper spawning stock. It is evident from a comparison of mean annual abundances, coefficients of variation of mean abundance (CV), and annual proportion occurrence in the two plankton gear types that vermilion snapper larvae are taken more consistently in bongo than in neuston samples. CV's over the time series for bongo net catches are lower and relatively more stable than for neuston net catches. We recommend that the vermilion snapper index of larval abundance be based on bongo net samples from the SEAMAP Fall Plankton survey. This index, as reported in working document SEDAR9-DW-24, should be considered a nominal or raw index only.

Two sampling issues were discussed by the workgroup that need addressing before standardized larval indices are constructed and evaluated. The first was duplicate and/or multiple sampling at some SEAMAP systematic grid sites, and the second, was gaps in spatial coverage over the survey area. Two methods to mitigate any potential bias in survey indices caused by variable spatial coverage were discussed. First was a two step process to filter sample sites used to estimate larval abundance. Step one deletes duplicate samples at a systematic grid site, retaining a single sample at each grid site in accordance with SEAMAP sample design. Priority is given to samples collected by NMFS vessels since these vessels generally collect the majority of survey samples overall, and then to the sample nearest the actual grid site. The second step deletes any sites on the systematic grid not sampled during at least 75% of years in the time series resulting in a more consistent area of coverage over the time series.

The workgroup also briefly discussed the need to construct an age or size corrected index due to inter-annual differences in size (age) composition of vermilion snapper larvae over the index time series. It was decided that both adjusted (as described in Hanisko et al. SEDAR7-RW 7) and unadjusted indices will be constructed and compared. The final step will be construction of a model based larval abundance index using the delta-lognormal approach (Lo et al., 1992). Joanne Lyczkowski-Shultz will provide the final indexes prior to the August stock assessment. Separate east and west larval indexes have been requested. These will also be available prior to the assessment.

6.2 SEAMAP Reef Fish Survey:

The SEAMAP reef fish survey employs video cameras to estimate the abundance of fish associated with reefs and banks located on the continental shelf of the Gulf of Mexico. Fish traps are also employed to capture fish for aging. Details of survey design and estimates of abundance for vermilion snapper are in the working paper. We recommend the use of design-based estimates of abundance for vermilion snapper, gray triggerfish and greater amberjack. There was no advantage to using the model-based estimates because no gaps were present in the survey time series that could be accounted for using a GLM approach. The size of the fish observed during the survey come from two sources, fish captured in traps and fish measured on video tape with lasers. Lasers were first introduced in 1995. However, since both the capture of fish in traps, and the instances where fish are hit by lasers was infrequent, size distributions were not estimated. We report only the average size and size range of fish. Survey indices are presented in working paper SEDAR9-DW21. The size of vermilion snapper observed ranged from 135 mm to 586 mm FL. Therefore the video survey observes fish age 0+. Information from commercial and recreational catch of vermilion snapper indicates the largest catches of adults are from the Texas-Louisiana and Florida panhandle area of the Gulf of Mexico. However, the vermilion snapper larval catch data indicate large catches off of southwest Florida. The video data will be re-examined to tease out adult vermilion snapper abundance off southwest Florida. Additionally, the results of a 2004 survey will be added. These will be provided prior to the August stock assessment by Chris Gledhill, NMFS Pascagoula, MS. Separate east and west indexes have been requested. These will also be available prior to the assessment.

6.3 SEAMAP Trawl Surveys:

The procedures used in SEDAR7 to derive trawl survey indexes of abundance for red snapper (SEDAR7-DW- 1, 2; and the age composition portion of AW-15) were applied to vermilion snapper, and reported in SEDAR9-DW-27. A Bayesian modeling procedure is used to combine different survey designs from different time series to create a Fall index for 1972-2004, and a summer index for 1981-2004 based on the SEAMAP standard. Standard SEAMAP surveys are conducted between 5 and 50 fm, from Mobile Bay to the Mexican border. Vermilion snapper appear to be abundant enough to get useful indexes. However, we know from sporadic research vessel trawling and bycatch observer work that vermilion catch rates in the eastern Gulf are often much higher than they are in the SEAMAP trawl survey areas. Therefore, the SEAMAP trawl surveys may not be indexing a suitably large fraction of the total population. Vermilion snapper appear to have the most intense patchiness of any species examined to date, leading to large interannual fluctuations that may reflect more or fewer chance encounters with high density patches than real changes in overall abundance. Size composition data are available for 1987 forward. There often appear to be at least two peaks in the size frequencies consistent with two year classes. However, compared to red snapper, the separations are not as clean, and there are far fewer fish in the samples.

A temporary working group consisting of age / growth, larval index, and trawl index specialists met during the Data Workshop to interpret the size compositions from the SEAMAP trawl surveys collected in SEDAR9-DW-18, concentrating on the plots made from fish from all years, combined.

For vermilion snapper in the summer survey, there is a contribution of fish below 80mm that are clearly young of the year. However, as much of the annual recruitment has yet to occur, interannual variations in this peak cannot be expected to index year class strength. There is a much broad peak from 80 mm, dropping off above 200 mm, but continuing to 400 mm. This peak is almost certainly numerically dominated by age 1's, but based on the known large variations in age at size, could likely contain sizeable numbers of 2+s. The pattern of any possible exit from trawl vulnerability with increasing size or age is not known, but age 1's >200 mm are captured by hook and line on reefs. Therefore, it is possible that trawl surveys might favor capture of smaller 1's over larger 1's. At present, there has been no direct ageing of vermilion snapper from the trawl surveys, and we recommend starting that project. Until a time series of aged catches is established for the trawl surveys , the recommend interpretation of the summer survey index is to use the catch rate of fish >80mm as an index for 1+, with selectivity among ages unspecifiable from the survey alone.

In the fall survey, vermilion snapper show two peaks, with some overlap. Imposing a boundary between the peaks at 150mm would appear to be a reasonable approximation. The peak of smaller fish are clearly young of the year. The concern is whether recruitment is complete enough every year by the time of the fall survey such that year to year variations do index year class strength. Examination of larval survey catch rates (tables 2 & 3 of SEDAR9-DW-24) suggested that a substantial fraction of annual larval production might extend into October (perhaps 25%), but closer examination showed most October occurrences came from early October. Thus, there may be some contribution from spawning season variation to the interannual variation of the age 0 component of the trawl survey index, but it was felt that variation would usually be dominated by variation in year class strength, and thus should be considered in the assessment. The interpretation recommended for the peak of larger fish followed the same reasoning as the summer discussion – that fraction should be presently be treated as an index of 1+, without specifying a selectivity vector for ages from the trawl data at this time.

In red snapper (SEDAR7-AW-15), it was possible to establish age 0 / age 1 boundaries that varied over years. (The annual size compositions were not ambiguous for that more abundant species.) There are some cases of apparent shifting in the annual plots in SEDAR9-DW-18, but on an annual basis, the data become quite sparse. We decided to recommend against changing age 0 / age 1 boundaries among years. Such a procedure would probably add more noise than signal.

Scott Nichols will provide the age composition vectors prior to the August stock assessment. Separate east and west indexes have also been request. A west index will be provided for the assessment. An index from the easternmost sampling in the SEAMAP surveys will also be developed, but it may not be useful because so little of the eastern range is covered.

6.4 Summary of Outstanding Items:

In summary, fishery independent index items still outstanding, but slated for completion prior to the SEDAR9-AW in August are: final larval indexes: total, east, and west (Lyczkowski-Shultz); updated reef fish indexes (total), plus east / west breakouts (Gledhill), and trawl index age compositions and east / west breakouts (Nichols). In addition, the Reef Fish video data will be checked for the abundances in SW Florida (Gledhill).

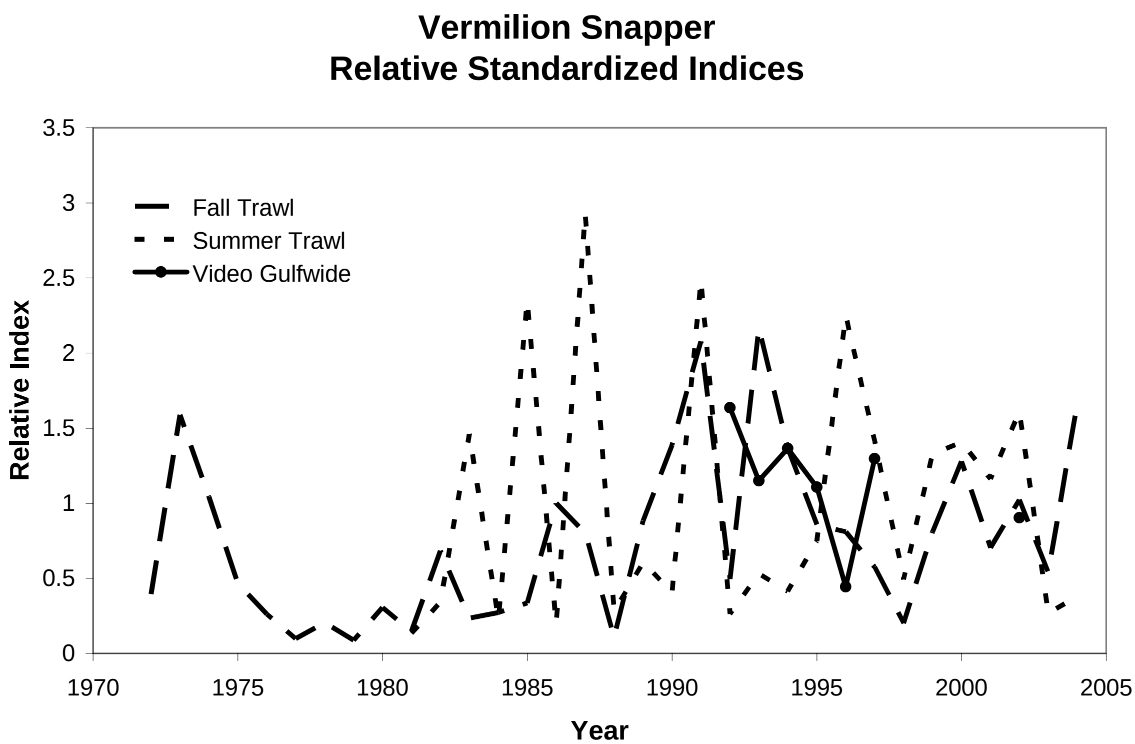


Figure 5.1 Relative standardized catch rate indices constructed using fisheries-independent data.

7. Release mortality

Limited information exists on catch and release mortality of vermilion snapper in the Gulf of Mexico. The only directed study (Burns et al. 2002) concluded that vermilion snapper are more susceptible to release mortality than red snapper, gag, and red grouper, but a mortality rate was not provided. Control fish, which were held in cages at depth of capture (up to 60 m) for 2 weeks had no significant mortality and showed little or no signs of decompression stress (e.g., everted stomachs, over-expanded swimbladders, protruding eyes). Based on low tag recaptures (0.7%) and the behavior of released fish held in tanks (all fish remained on the bottom of the tank until their vented swimbladders healed) the authors hypothesized that the main cause of release mortality for vermilion snapper is bottom predation.

In contrast, unpublished data provided by Bob Shipp at the SEDAR 9 Data Workshop suggest very low release mortality (5.5%) for vermilion snapper caught by the recreational fishery off of Alabama. Of the 72 vermilion snapper caught, tagged, and released as part of a MARFIN study, 68 swam vigorously towards the bottom (i.e., showed no significant signs of stress at the time of release) and were expected to survive. If we consider that the 4 fish that showed signs of stress at the time of release (i.e., oriented towards the bottom but swam erratically, or swam erratically and remained at the surface) would subsequently die, the estimated release mortality rate would be 5.5% (4/72).

Release mortality for vermilion snapper in the South Atlantic has been estimated at 17% for fish caught at depths of 43–55 m (Collins et al. 1999) and 27% for headboat catches (Dixon and Huntsman, unpublished data). The commercial fishery typically operates at greater depths than the headboat fishery, which the group believes would result in higher mortality rates. For that reason and based on the previous estimates, release mortality rates of 40% and 25% were recommended by the SEDAR 2 Data Workshop Life History Working Group for the South Atlantic commercial hook-and-line and headboat fisheries, respectively.

7.1 Recommended ranges

Given the lack of solid information on release mortality of vermilion snapper in the Gulf of Mexico, the Life History Working Group recommended that a range of values be used for sensitivity analysis. After discussion during the plenary session (including input by commercial and recreational fishers) the group decided that sensitivity runs be based on the following range of values:

(1) Private recreational: 10-40%

(2) Headboat: 40-60%

(3) Commercial hand-line: 40-75%.

The logic was to add 0.1 to the observed acute, immediate, at the surface mortality to provide a minimum for the range with the upper bounds set substantially above the minimum in order to provide a reasonable range of response. Typically upper bounds were set 0.3 or more above the lower bound.

7.2 Literature cited

Burns, K.M., C.C. Koenig, and F.C. Coleman. 2002. Evaluation of multiple factors involved in release mortality of undersized red grouper, gag, red snapper, and vermilion snapper. Mote Marine Laboratory Technical Report No. 790.

Collins, M.R. J.C. McGovern, G.R. Sedberry, H.S. Meister, and R. Pardieck. 1999. Swim bladder deflation in black sea bass and vermilion snapper: potential for increasing post release survival. N. Am. J. Fish. Manage. 19:828-832.

Dixon, R. L. and G.R. Huntsman. Unpublished. Survival rates of released undersized fishes. NMFS Beaufort.

8. APPENDICES

8.1 APPENDIX 1. TEXAS RECREATIONAL LANDINGS

Recreational landings estimates for TX, 1981-1985.

Prepared June 21, 2005, Patty Phares

I. Available estimates for gray triggerfish, greater amberjack and vermilion snapper in TX

A. TPWD Management Data Series 204 – Private and charterboat only (no headboat).

Annual landings estimates, with a year defined as May 15 - May 14, for 1983/84 through 1997/98.

(Estimates for 1998-99 and later years have not been received yet.)

These annual estimates are what TPWD uses and are based on the same survey data they use to compute the TPWD wave estimates sent to us. If landings by wave are not needed, these annual estimates may be best, at least until the wave estimates for 1983-1997 are replaced (see notes below).

Notes:

(1) The annual estimates were recomputed in the mid-1990s using a revision to the "pressure files", thus eliminating some extreme estimates.

The wave estimates for the 1980s and early 1990s have not yet been recomputed to use the revised pressure files and still contain outliers which may disappear when the wave estimates are recomputed.

(2) The annual estimates are based on 2 fishing seasons (high use and low use) and may be more precise than the sum of the 6 wave estimates.

(3) The annual estimates incorporate data entry corrections not yet made to the wave estimates.

(4) TPWD makes species-specific estimates for selected "target species". The rest of the species are combined in to "other". A "substitute" estimate can be derived for the species in "other" based on the counts of species observed, but these may not be very reliable estimates.

The annual estimates have species-specific estimates for each of these 3 species in gulf areas (not bays) in all years.

Before 1994, the wave estimates have species-specific estimates for vermilion snapper in gulf areas but not for gray triggerfish and vermilion snapper.

B. TPWD Management Data Series 29 and 58 – gulf headboats, through May 1983.

(#29) Annual landings estimates (use gulf headboats):

Sept 1978 - Aug 1979

Sept 1980 -- Aug 1981

Sept 1981 -- Aug 1982

(#58) Landings estimates for a partial year (use gulf headboats):

Sept 1 1982 -- May 14 1983

Notes:

(1) These MDSs were published in 1984 and may not incorporate needed revisions as do those in MDS 204 (no confirmation from TPWD on this yet).

(2) The Sept-Aug years are not comparable to either the May 15-May 14 years or to calendar years.

(3) According to the MDS, not all headboat in the survey areas were found and contacted (apparently a census was attempted) and possibly not all regions were covered (survey areas listed do not include the current "major areas" of gulf waters off Sabine Lake, Matagorda, San Antonio). **The MDS 29 states "Harvest estimates in this study should be considered minimum estimates...".**

C. TPWD wave estimates (estimates made for NMFS) – summed into May-April.

Summed to be comparable to TPWD annual estimates in A (May 1 - April 30, 1983/84 -- 2002/03).

Private and charterboats all years, headboats only in May 1983 - Aug 1984.

D. TPWD wave estimate (estimates made for NMFS) – same as C. but summed into annual Jan-Dec

Summed into annual estimates (Jan-Dec) as would be used in assessments.

Private and charterboats (wave 3-6 only in 1983), headboats only in May 1983 - Aug 1984.

F. MRFSS 1981- 1985. The only estimates are:

1981 waves 2, 3, 5, 6 (waves 1 and 4 are missing). All modes, charterboat and headboat combined.

1982-1984 waves 1-3, 5-6 (wave 4 is missing). Only shore mode.

1985 waves 1-2, 5-6 (wave 4 is missing). All modes, charterboat and headboat combined.

G. NMFS HEADBOAT SURVEY, 1986-1989

Use these estimates to evaluate magnitude and trends in pre-1986 headboat landings in TX.

Before 1997, TX landings were combined for Jan-May and for Sept-Dec.

Area (TTS, EEZ is not known), but all can be assigned to EEZ (area=4) for this purpose. These are gulf headboats (not in the bays).

II. Summary of "holes"

If both MRFSS and TPWD wave estimates are used:

* charter and headboat are combined in MRFSS (are bay headboats included in MRFSS?) .

x = "hole" (no survey or MRFSS estimate lost)

		Shore	Private	Charter	Headboat (gulf)	Headboat (bay)
1981	wave 1	x	x	x	x	x
	wave 2	MR	MR	MR*	MR*	with gulf?
	wave 3	MR	MR	MR*	MR*	with gulf?
	wave 4	x	x	x	x	x
	wave 5	MR	MR	MR*	MR*	with gulf?
	wave 6	MR	MR	MR*	MR*	with gulf?
1982	wave 1	MR	x	x	x	x
	wave 2	MR	x	x	x	x
	wave 3	MR	x	x	x	x
	wave 4	x	x	x	x	x
	wave 5	MR	x	x	x	x
	wave 6	MR	x	x	x	x
1983	wave 1	MR	x	x	x	x
	wave 2	MR	x	x	x	x
	wave 3	MR	TX	TX	TX	TX
	wave 4	X	TX	TX	TX	TX
	wave 5	MR	TX	TX	TX	TX
	wave 6	MR	TX	TX	TX	TX
1984	wave 1	MR	TX	TX	TX	TX
	wave 2	MR	TX	TX	TX	TX
	wave 3	MR	TX	TX	TX	TX
	wave 4	X	TX	TX	TX	TX
	wave 5	MR	TX	TX	x	TX
	wave 6	MR	TX	TX	x	TX
1985	wave 1	MR	TX/MR	TX/MR*	x/MR*	TX/MR*
	wave 2	MR	TX/MR	TX/MR*	x/MR*	TX/MR*
	wave 3	MR	TX/MR	TX/MR*	x/MR*	TX/MR*
	wave 4	x	TX/x	TX/x	x/x	TX/x
	wave 5	MR	TX/MR	TX/MR*	x/MR*	TX/MR*
	wave 6	MR	TX/MR	TX/MR*	x/MR*	TX/MR*

III. DISCUSSION

Comparing data sources in Tables 1 and 2, there is not appearance of comparability among data sources. For instance, in Table 1(a) for gray triggerfish, the TPWD Management Data Series estimates (based on May15-May14 year) and TPWD wave estimates made for NMFS are very different in many years. For MRFSS, there are almost no gray triggerfish estimates, but the leatherjacket family (Table 1(d) bears slight resemblance to the estimates from other sources.

This is true for private and charter (including MRFSS charter + headboat) for all three species (gray triggerfish, greater amberjack, vermilion snapper).

For headboats (without charterboats) compared between TPWD and the NMFS Headboat Survey, the comparisons cannot be made in the same year, but the general magnitude of TPWD estimates before 1985 is not like that of Headboat Survey estimates in 1986+ except for vermilion snapper.

Comparisons are destined to be faulty because of the abundance of “holes” and the different time periods for estimates (not the same 12-month period), different grouping of modes (charterboat and headboat alone vs. separate), and poor quality of some of the estimates. The TPWD wave estimates for these years do not have the benefit of revisions slated to be done, and the sampling levels are especially low for charterboats. The MRFSS estimates before 1986 also are considered less reliable – the charterboat component uses the “old” method for charterboats, and there are weaknesses in the estimates for all modes (early years of survey, less thorough editing of data when all estimates were revised in early 1990s, some procedural or methodological differences?).

In short, it’s too messy to try to consolidate the different estimates and fill in the holes. My suggestions are:

(1) Use MDS private and charterboat estimates for 1983-1997 (and use then as though they are calendar year estimates)

(2) Use TPWD wave estimates for 1998+ (these use the calculation procedures that will be applied to the earlier years when time allows for TPWD to do replace the old estimates).

(3) Use the average of the Headboat Survey for 1986-1989 for all years 1981-1985 (perhaps modified by Bob Dixon and TPWD if they believe the fleet was smaller or different).

If this is unsatisfactory, anyone’s procedure may be just as good. But there will never be more data, just re-hashing of the same data presented here.